COMPREHENSIVE ASSESSMENT OF THE PEANUT VALUE CHAIN FOR NUTRITION IMPROVEMENT IN GHANA

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AgSSIP	Agricultural Services Sub-Sector Investment Project
CAADP	Comprehensive Africa Agricultural Development Program
CERGIS	Center for Remote Sensing and Geographic Information Services
CIDA	Canadian International Development Agency
CIDA	Canadian International Development Agency
CRI	Ghana Crops Research Institute
CRIG	Cocoa Research Institute of Ghana
CRSP	Collaborative Research Support Program
ECASARD	Ecumenical Association for Sustainable Agriculture and Rural Development
FAO	United Nations Food and Agriculture Organization
FAOSTAT	United Nations Food and Agriculture Organization Statistical Database
FASDEP	Food and Agricultural Sector Development Policy
FBO	Farmer Based Organization
FDA	Food and Drugs Authority of Ghana
FRI	The Food Research Institute
GCAP	Ghana Commercial Agriculture Project
GDP	Gross Domestic Production
GFBD	Ghana Food and Drugs Board (now Food and Drugs Authority of Ghana)
GHC	Ghanaian Cedi (approximately 1GHC = 0.5USD as of August 2013)
GPRS	Growth and Poverty Reduction Strategy
GSA	Ghana Standards Authority (formerly Ghana Standards Board)
ha	Hectare (= 2.47 acre)
MOFA	Ministry of Food and Agriculture
mt	Metric tons (=2,204.62 pounds)
NRGP	Northern Rural Growth Project
PMIL	Peanut and Mycotoxins Innovation Laboratory
RELC	Research and Extension Linkages Committee
SADA	Savannah Accelerated Development Authority
SARI	Savannah Agricultural Research Institute
USADF	United States African Development Foundation
WFP	United Nations World Food Program

EXECUTIVE SUMMARY

This report analyzes the peanut value chain in Ghana, aiming to identify opportunities for new investment and interventions to improve nutrition and livelihoods on a commercial scale. The report aims to:

1. Describe the current peanut value chain from seed to processing, so as to identify improvements needed for the introduction of increasingly nutritious products;
2. Analyze the agricultural policy and public-sector enabling environment around the value chain, including legal and institutional arrangements that could influence the production and distribution of new products; and
3. Report the opinions of key informants along the value chain, including details of farmers' enterprise budgets as well as potential partners' subjective perceptions of the constraints and opportunities facing new peanut-based products.

Our study is based on an extensive desk review of public-domain materials, followed by fieldwork in Ghana in July and August of 2013. This report provides a comprehensive assessment of the peanut value chain today; identifying specific options and recommendations for how new investments could improve livelihoods, especially for women, and improve nutrition on a large scale in an economically sustainable manner.

The introduction to the report summarizes the nutritional contribution of peanuts in Ghana, followed by a comprehensive assessment of the value chain from inputs through farm production, marketing and processing to final consumption. That assessment includes a review of the country's agricultural policies and investment priorities, the role of peanuts in nutrition and health, and key areas for intervention to strengthen the value chain with extensive detail on each stage of production, post-harvest handling and marketing. This assessment leads directly to our conclusions, and is based on extensive literature review and findings from key informant interviews conducted in June, July and August of 2013 summarized in a standalone annex than can also be read independently.

The value chain assessment provided in this report is intended to inform a variety of potential investments and interventions to improve nutrition and livelihoods in Ghana, by improving availability, access and use of peanuts on a commercial scale. The report describes:

1. the current peanut value chain from seed to processing;
2. the public-sector enabling environment around the value chain; and
3. the experience of key informants, including farmers' enterprise budgets.

Taken together, each aspect of the peanut chain poses significant constraints but also offers great opportunities for new peanut-based products to improve nutrition and also promote economic growth. The central feature of these products is to offer nutritionally vulnerable farm households new income-earning opportunities, expanding availability and access to the nutrients in peanuts while protecting consumers from aflatoxin contamination.

Our conclusions can be summarized briefly as follows:

(a) New investments in the peanut value chain can be commercially viable, and provide significant improvements to the livelihoods and nutritional status of farm households in northern Ghana;

(b) The central challenge is to procure large quantities of aflatoxin-free peanuts, which requires development of a new and more secure supply chain in the midst of the larger uncontrolled market;

(c) The most robust new supply chain for aflatoxin-free peanuts is likely to involve aggregators' spot and contract purchases from rainfed smallholder producers, including particularly women farmers, potentially supplemented by other sources such as imports and contracts for production under irrigation;

(d) The most important mycotoxins include aflatoxin and fumonisin. These are known carcinogens and also suppress various aspects of disease immunity and cell function. Aflatoxins are known to cross the placental barrier, and in utero exposure has been shown to impact subsequent infant growth in the first year of life, with two studies in West Africa showing clearly the relationship between aflatoxin exposure and growth retardation;

(e) Building supply for this new value chain will require equipping farmers and aggregators with select new technologies to which they do not yet have access, including improved seed varieties and techniques for aflatoxin control;

(f) The investments and interventions introduced for this innovation are likely to generate significant spillovers benefits for other households producing peanuts for other end-uses, with potentially large gains in livelihoods and nutritional status especially for women and children.

INTRODUCTION: THE NUTRITIONAL VALUE OF PEANUTS IN GHANA

Despite the rapid growth of Ghana's economy, nearly 2 million Ghanaians remain vulnerable to food insecurity. As in other developing countries, the most food insecure and malnourished are predominantly rural people in remote areas who are left behind by urbanization and income growth elsewhere. Even as the country as a whole experienced rapid transition to middle-income status, the 2010 census found that almost half of all Ghanaian households were still engaged in agricultural activities and that eighty percent of them were cultivating 1.2 hectares or less (1, 2). Poverty and malnutrition remains particularly widespread in the isolated north of the country, where limited and erratic rains, depleted soils and limited market access make it difficult for households to either raise agricultural productivity or find non-farm work.

Peanuts (*Arachis hypogaea*, known in Ghana and elsewhere as groundnuts) are leguminous, nitrogen-fixing beans that are well suited to cultivation in the relatively dry savannah zones of Africa. They are widely grown in northern Ghana for both home consumption and sale, with women actively involved in the harvest, processing and marketing of peanuts. Relative to other staple crops, peanuts are a high-value, readily marketable and nutritious food, used as an ingredient in many traditional dishes and snacks as a major source of energy, protein, vitamins and minerals. Peanuts are a good source of total energy, fat (especially mono unsaturated fat) and vitamins and minerals including niacin, folate, copper and manganese (3). The nutritional profile of peanuts per 100 g portion is provided in Table 1 (4). Peanuts are good sources of protein though need to be complemented with starchy staples such as corn (5). With additional vitamin and mineral fortificants, peanut butter products have come to be utilized globally for the treatment and prevention of malnutrition in infants and young children, and peanut-based snack foods can also be fortified to offer low cost products of very high nutritional value to reach the base of the economic pyramid.

Table 1: Nutrient composition of raw peanuts

Nutrient	Unit	Amount per 100 g
Energy	kcal	567
Protein	g	25.8
Fat	g	49.2
Fatty acids, total saturated	g	6.8
Fatty acids, total monounsaturated	g	24.4
Fatty acids, total polyunsaturated	g	15.5
Carbohydrate	g	16.1
Fiber	g	8.5
Calcium, Ca	mg	92
Iron, Fe	mg	4.6
Magnesium, Mg	mg	168
Phosphorus, P	mg	376
Potassium, K	mg	705
Sodium, Na	mg	18.0
Zinc, Zn	mg	3.27
Thiamin	mg	0.64
Riboflavin	mg	0.13
Niacin	mg	12.1
Vitamin B-6	mg	0.35
Folate, DFE	µg	240
Vitamin E (alpha-tocopherol)	mg	8.3

Peanuts also form a significant part of the Ghanaian diet. Examining food availability data from the UN Food and Agriculture Organization (FAO) database for 2009, peanuts contributed similar levels of energy and fat compared to animal products as well as a small amount of protein. Peanuts contributed to 3% of total energy availability per capita and 16% of total fat and 6.5% of total protein availability per capita compared to 4.4% total energy, 27% total protein and 13% total fat from animal products (Table 2).

Table 2: Contribution of peanuts to energy and protein per capita in 2009

Item	Energy	Protein	Fat	Percent of total energy	Percent of total protein	Percent of total fat
	kcal/day	g/day	g/day	%	%	%
Total	2934	60	46.4	100.0	100.0	100.0
Vegetable Products	2805	43.9	40.2	95.6	73.2	86.6
Animal Products	129	16.1	6.2	4.4	26.8	13.4
Peanuts	*92*	*3.9*	*7.5*	*3.1*	*6.5*	*16.2*
Pulses, Treenuts, Coconuts	38	0.8	2.5	1.3	1.3	5.4

Source: FAOSTAT (6). Data refer to estimated availability from production and loss data, not dietary recall surveys.

Along with cocoa, maize, yams, cassava, plantain, pineapple, and rice, peanuts are one of the larger crops grown in the country with total 2010 in-shell production reported to be 530,887 mt (2). Ghana ranks as the 10th largest producer of peanuts in the world but it must be noted that all of this appears to be consumed domestically (7). Perhaps because of the crop's status as a traditional food grown primarily for the domestic market, public investment to raise productivity and strengthen the value chain from farmers to end-users has been relatively limited. In Ghana, agricultural policy and programming seems primarily focus on starchy staples such as maize, rice or cassava, or export commodities such as cocoa or oil palm. A recent classification of the country's agricultural research programs found that groundnuts did not even make the list of top eight crops, attracting less than 4.5% of Ghana's agricultural research effort (8).

New investments to develop innovative peanut products in Ghana could offer an unusual opportunity to improve productivity, diet quality and health, through a relatively neglected value chain that links northern low income peanut growing households to low-income consumers around the country. This report provides a comprehensive assessment of the peanut value chain as a whole, and identifies specific options and recommendations for how new investments could improve livelihoods, especially for women, and improve nutrition on a large scale in an economically sustainable manner.

The report is structured in modular fashion, centering on Part 1: a broad assessment of the value chain from the provision of farm inputs through processing to the final consumer, including analyses of agricultural policy and investment priorities, the nutritional contribution of peanuts and the health risks from contamination, with key areas for intervention in the value chain to improve nutrition and health. This introduction, our conclusions and annexes all aim to frame this assessment, as a standalone document aimed at guiding a variety of potential investments. An optional Part 2 focuses on one particular such initiative, with a SWOT analysis and recommendations that can be removed from the larger report as needed for particular audiences.

COMPREHENSIVE ASSESSMENT OF THE PEANUT VALUE CHAIN IN GHANA

1. Agricultural policy and investment priorities

While agricultural production and incomes have risen quickly in coastal southern Ghana, rural poverty rates remain stubbornly high in the drier, more isolated northern regions of the country. Key factors include low and variable crop yields due to poor rainfall, low soil fertility, as well as high transport costs that keep farm gate prices higher for inputs and lower for outputs than for farms in less isolated areas. Limited market access also leads to high storage losses, as crops are not brought quickly to market but typically remain vulnerable to pests and diseases under poor storage conditions for months after the harvest.

The Government of Ghana's Medium Term Agriculture Sector Investment Plan (METASIP) as well as the US Government's Feed the Future strategy for Ghana both specify the need for investments aimed at helping farmers shift from semi-subsistence agriculture to increasingly attractive commercial opportunities (1, 9). Many of these investments involve indigenous Ghanaian firms, and others involve US or other multinational firms capable of linking local farms to global markets with state-of-the-art technological and organizational innovations.

Over time, national governments and international agencies such as USAID have found that a cost-effective way to achieve poverty reduction and nutrition improvement is to invest simultaneously in agricultural production efficiency, improved access to a diverse and nutritious diet, and care practices needed for healthy growth particularly among low-income women and children (10). Many success stories around the world validate this approach (11).

In Ghana, the government's investment plan METASIP aims to spread Good Agricultural Practices (GAPs) in the marketing of agricultural produce, through collaboration with local authorities and value chain actors in the public and private sector. The METASIP identifies key new priority crops, based on the country's Food and Agriculture Sector Development Policy II (FASDEP II), calling for a focus on mango, oil palm, rubber, plantain and citrus at the national level, and to promote cotton, soybean and sheanuts in the Northern Savannah areas where poverty is endemic and the income generating potential of these crops is high.

METASIP notes that peanuts are distinctive among the country's traditional staple crops in having the highest rate of commercialization among producers , with 69% of peanut farmers selling much of their output. While the METASIP highlights the opportunity to improve industrial processing of the country's traditional commercialized smallholder crops, the investment plan places little emphasis on peanuts in particular. Furthermore it has no focus on the specific food safety and nutritional issues associated with peanuts and other crops, such as contamination by mycotoxins. But the plan does highlight key challenges facing Ghanaian agriculture which could be helped by addressing these problems in peanuts, notably the difficulties of rain-fed agriculture, a low level of mechanization in production and processing, high post harvest losses due to poor post harvest management, low and ineffective agricultural finance, poor extension services due

to institutional and structural inefficiencies and inadequate markets and processing facilities. Strategic investments in the peanut value chain can potentially help alleviate all of these constraints on rural livelihoods and nutrition improvement.

2. Nutritional status of vulnerable groups

The nutritional status of Ghanaian women and children is improving with national economic growth, but malnutrition remains a significant problem particularly in the relatively low-income, peanut-growing northern regions. The most recent Demographic and Health Survey (DHS 2008) found Ghana's rates of stunting, wasting and underweight in children aged 0-59 months to have been 28%, 14% and 9% respectively (12). As in most countries, stunting rates are higher in rural than urban areas (32% as opposed to 21%), and notably so in the far north Upper East region (36%). Children in the far north of the country also have relatively high rates of wasting (low weight for height), with rates in the Upper East, Northern and Upper West found to be about 11%, 13% and 14% respectively.

Since the DHS survey of 2008, the UNICEF Multiple Cluster Indicator Survey (MICS) of 2011 found a stunting rate of 37% in the Northern region, even higher than the rate of about 32% in the Upper East. Wasting remained high in the Northern and Upper West regions, at 13% and 14% respectively(12). An analysis of these data by Somuah-Anim et al (13) found that chronic malnutrition in the Northern regions is linked to household poverty, ecological constraints, high disease burden (malaria, HIV/AIDS, intestinal worms, diarrheal diseases), inadequate health and sanitation facilities and infant and young child feeding practices (1, 14). Rural people generally consume less protein and oils than urban Ghanaians; among children, consumption of iron and Vitamin A rich foods was the lowest in the Northern region (77%)(12, 13).

A targeted survey of the Upper West, Upper East and Northern regions by the World Food Programme found more than 680,000 people who are severely or moderately food insecure. Of these 140,000 were also found to have inadequate dietary diversity, with diets consisting only of staple foods, some vegetables and oil. These were most likely to be the poorest households with the least land. They are also often female-headed households and those with the least education. But agriculture was the most common way for these households to survive (15).

The incidence of malnutrition is closely linked to both household agricultural production and access to food from markets. Overall, 88% of households in Northern Ghana rely on crop cultivation as their primary source of livelihood, but with limited land area and low yields due to insufficient and erratic rainfall as well as pests and diseases, many of these households must use nonfarm earnings to buy additional food beyond what they can grow themselves (15). Since poorer households need to spend a larger share of their time and income producing or buying food than richer households, they are particularly vulnerable to both shortfalls in their own production and higher prices for the foods they must purchase from others.

3. Nutrition and health through the peanut value chain

Nutrition-sensitive agricultural programs that aim to improve availability, access and use of nutrient-dense foods are needed for a more diverse and nutritious diet to become affordable, particularly in northern Ghana and other rural areas (13). Investments along the value chain from production to consumption can achieve that objective by strengthening the linkage between agriculture and nutrition, as illustrated by the recently developed conceptual frameworks outlining various pathways by which enhanced agriculture can improve nutrition. In such a framework (16), the pathways by which investments in agriculture can improve nutrition in the farm household include the following six distinct channels of impact:

- Increasing households' agricultural production as a source of their own nutrient rich food;
- Increasing households' agricultural income to buy food from others;
- Increasing availability and reducing prices of diverse foods for food buyers;
- Increasing use of agricultural income for non-food expenditures that improve nutrition such as sanitation, health care and education;
- Increasing use of agricultural activities to empower women and improve their socio-economic status, control of resources and influence on decision-making; and
- Increasing opportunities for women involved in agriculture to manage care, feeding and health of young children and improve their own nutritional and health status.

Specific investments may target one or more of these six pathways. This particular conceptual framework focuses on agriculture-nutrition linkages around the farm gate, while other approaches might focus on resources and input use, or post-harvest marketing and processing which may or may not have value adding activities along the chain thereby affecting nutritional value of the commodity and nutrition from the perspective of availability, affordability and access on the demand end. This is illustrated by Hawkes and Ruel and Anim-Somuah et al (17) (13). Anim-Somuah et al outline the difference between the pre-farmgate and post-farmgate approach. The pre-farmgate approach focuses on increasing production of nutrient dense foods and their consumption within farming households and their local communities that grow those foods. By remaining on the farm, these have limited reliance on markets and value chains, and a limited ability to improve nutrition for non-agricultural consumers (13).

The post-farm gate approach links agricultural production to non-agricultural rural and urban populations thus providing access to food beyond the farm. The value chain approach in linking nutrition to agriculture begins with a different objective then one that aims to promote pre-farm gate consumption. The approach begins with the populations affected by undernutrition and works backwards through the value chain to improve delivery of nutrient dense foods to these populations. This approach engages different sectors including the private sector, government and civil society. Hawkes and Ruel further expound on the concept of "value chains for nutrition" indicating that constructing a value chain allows identifying where along the supply side nutritional value can be created in addition to the necessary economic value to the actors in the supply chain. On the other

hand, on the demand side, use of value chain approaches allows for the creation of "perception of nutritional value". Within the construct of "value chains for nutrition" consumers are actors rather than a "market". Value chain development allows nutrition and health goals to be clearly identified with needs for both at risk producers and consumers being considered (17).

To identify the particular opportunities and constraints for nutrition improvement through investments in Ghana's peanut value chain, we address both production and post-farm issues and the concept of agriculture linked to nutrition through the value chain approach. In so doing, a principal concern is the control of mycotoxin contamination, drawing on the recent public-health evidence that links mycotoxins to poor nutrition and growth in infants and young children (presented in a separate text box). Aflatoxins are a naturally occurring mycotoxin produced by many species of *Aspergillus*, a fungus, the most notable ones being *Aspergillus flavus* and *Aspergillus parasiticus*. More than 4.5 billion people in developing countries may be chronically exposed to aflatoxins in their diet. Aflatoxin contamination most often occurs when crops suffer stress such as high rainfall, high temperatures, drought, and insect infestation which allows the fungi to grow on the outer surface of the peanut pod and spreads inward reaching the kernel. Any damage to the integrity of the shell from boring insects of rough handling only accelerates the infection of the kernels.

The incidence of these toxins in Ghanaian peanuts and other crops has been well documented for many years. Awuah and Kpodo (1996) found peanut samples from 21 selected markets in 10 regions of Ghana with high levels of the toxin; infection was found in 31.7% of the damaged kernels examined, and 12.8% of the undamaged kernels. As a result, an estimated 5 to 15 percent of peanut in Ghana are discarded during sorting (18).
The European Union has as of February 18, 2013 imposed safeguard measures against the imports of peanuts from Ghana and India, mandating that all peanuts originating from these two countries to be exported to the European Union will have to be submitted to aflatoxin controls at point of origin. These problems are potentially as or more serious for processed peanut products as for raw nuts, as shown in a 2010 study by IFPRI that tested 70 samples of various kinds of peanut-containing foods; detailed results from that study are shown in Table 3 below.

The growth of fungi and hence aflatoxin contamination can be controlled along the value chain, particularly in the immediate postharvest period. Peanut farmers' decisions and practices for the initial drying, sorting and storage of peanuts heavily influences the extent fungal growth. Aflatoxin contamination most often occurs when crops suffer stress, such as high rainfall and high temperatures and drought and insect infestation which enable the fungi to grow on the outer surface of the peanut pod and spreads inwards reaching the inside of the kernel. Harvest and post-harvest handling activities predisposes the harvested product to more infestation. The longer the product is exposed, the more the likelihood of infestation. In the harvesting of peanuts, the method of hand pulling, and if it is dry soil, the use of hoes from the soil results in high pod cracking, predisposing the pods to infestation. After harvest, peanut farmers rarely sell immediately, as peanuts with high moisture content are discounted heavily (19).

In Ghana, peanuts are dried in shell but typically shelled on farm prior to sales. Drying of nuts occurs on open and concrete or hard-pan clay surfaces followed by shelling and packing (usually after minimal sorting) into storage containers (such as clay pots, gourds, mud silos, jute sacks, plastic bags, plastic drums and glass bottles), the latter being a major source of infestation. Storage bags are not checked for pest infestation before being re-used to store newly harvested peanut thus predisposing the nuts to contamination and infestation from previously stored batches. Aggregators and traders also store shelled peanuts in used jute sacks that may have been previously used for storing other grains to meet market demands. Lack of proper sorting, a longer period storage in a shelled form and re-use of storage containers that are not checked or cleaned by traders increases the risks of fungal growth.

At the various farmer schools held in the region training of farmers to help in the control of aflatoxins has concentrated on 1. selection and planting of healthy seeds, 2. effective weed management, 3. effective disease management, 4. management of boring soil pests which create holes in the shells allowing infiltration of the fungus responsible, 5. timely harvest, 6. drying harvested nuts to the required moisture content before storage, 7. sorting of shriveled or rancid peanuts, and 8. proper storage conditions (20).

Aflatoxins are also an issue for maize and other grains grown in the region and there have been various programs aimed at educating farmers in methods to control it. For instance, a workshop was held in May 2013 for 60 farmers of maize and other grains to equip them with practical knowledge on how to handle their crops to minimize aflatoxin infection. The workshop was cosponsored by the Ecumenical Association for Sustainable Agriculture and Rural Development (ECASARD), The Food Research Institute (FRI), and SENDGhana with funding from Southern African Trust (21). Once again, the focus of such efforts is aimed at crops other than peanuts, but it may be possible to tap such resources for the peanut farmers as well.

Text Box: Recent evidence on mycotoxins, nutrition and health

Peanuts are particularly vulnerable to fungal growth and mycotoxin contamination, which recent public-health research has shown to be a serious, previously under-appreciated threat to nutrition and health in Africa. The hazard is most severe for infants and young children, when visibly damaged food is not discarded, and where previous malnutrition worsens susceptibility.[1]

The most important mycotoxins include aflatoxin and fumonisin, which are known carcinogens[1] and also suppress various aspects of disease immunity and cell function.[2] Specific mechanisms include gastrointestinal conditions, diarrhea and enteropathy, as well as interference in carbohydrate metabolism, lipid synthesis, and nutrient utilization3,4 Aflatoxins are known to cross the placental barrier[5], and in utero exposure has been shown to impact subsequent infant growth in the first year of life. [6,7,8,9,10,11]

Two studies in West Africa show clearly the relationship between aflatoxin exposure and growth retardation. First, Gong et al reported that aflatoxin adducts in blood serum was highly associated with stunting across children, showing a clear dose-response relationship with both heights and weights.[12] A longitudinal study then confirmed that result over time, finding children in the highest quartile of exposure having 1.7 cm less height gain than those in the lowest quartile.[13]

The social cost of mycotoxins in maize and peanuts includes these effects from what is actually consumed by people and animals, but also the degree to which the risk of damage inhibits the development of commercial markets for foods that are not actually contaminated. Studies have just begun to measure the impacts of mycotoxins and help design effective control measures for Africa, so careful attention to the latest evidence will be needed to manage this invisible threat to nutrition, health and economic development.

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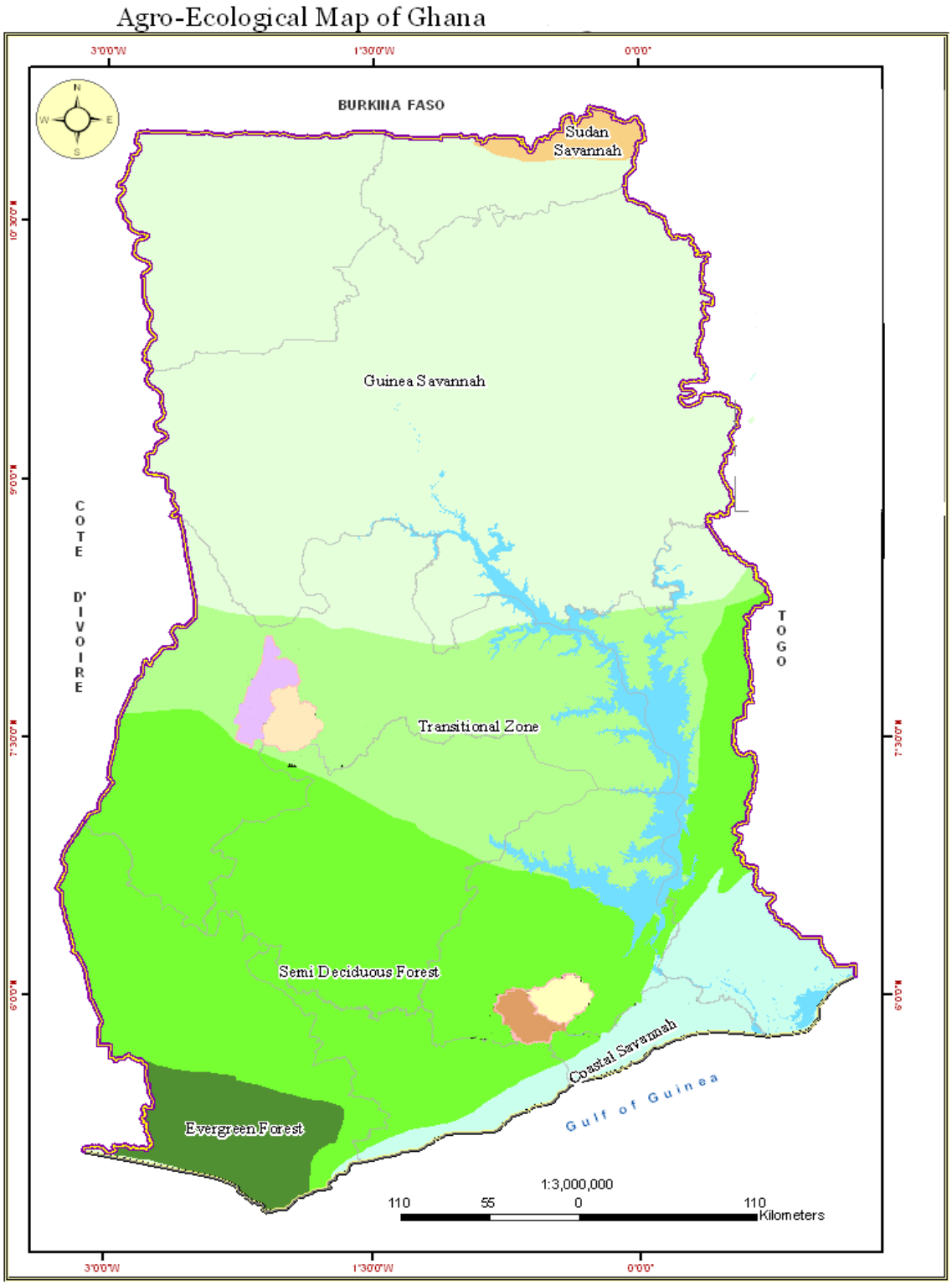
4. Peanut production and marketing

Peanuts are cultivated primarily in the drier, northern half of the country, under savannah and transitional-savannah conditions. These regions account for 94% of the country's peanut production, which is facilitated by a uni-modal rainy season from April-May to September-October with total precipitation on the order of 900-1100 mm a year, followed by a dry period for post-harvest operations and marketing.

In a typical farming community in northern Ghana, almost all farm families will cultivate some peanuts, and of their crops it the one most likely to be marketed commercially: in one survey, more than 90% of households grew peanuts, and 72% of them sold some of their crop (22). Very few purchased inputs are used in peanut production, however, so it can be described as a commercial activity produced in a traditional, semi-subsistence manner.

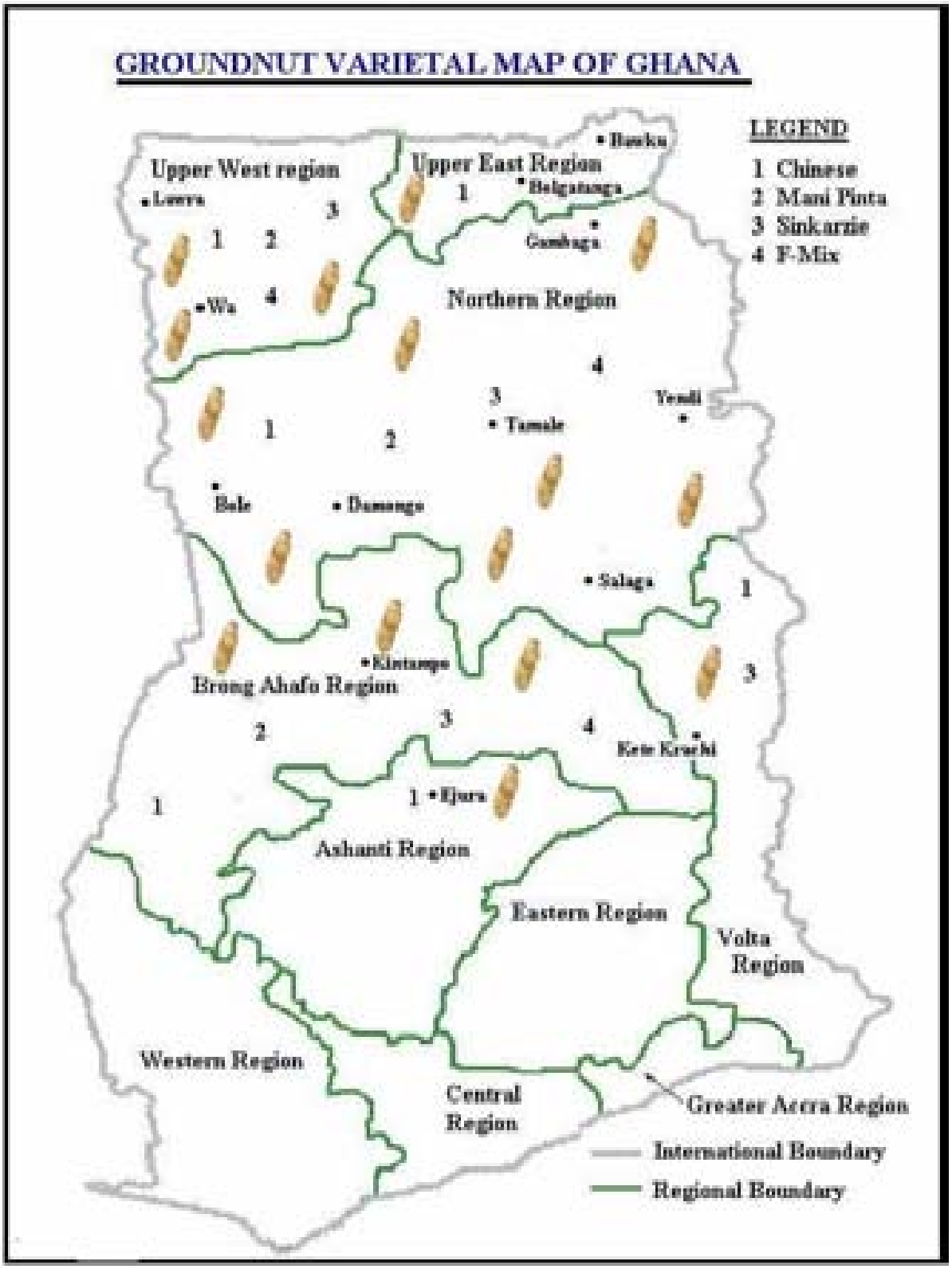
The agro-ecological zones in which peanuts are grown are primarily classified as Guinea Savannah and Sudan Savannah areas, located primarily in the Northern, Upper East and Upper West administrative regions of Ghana. The figures below illustrate these agro-ecological zones and peanuts' primary location and varieties grown relative to the country's administrative regions.

Figure 1: Map of agro-ecological zones



Source: FAO

Figure 2: Map of peanut production, varieties and administrative regions



Source: (23)

The list of varieties illustrated on the map above reflect the largely traditional, semi-subsistence production technology used for peanuts in Ghana. The local landrace type, known as bulga or bugla, was selected by farmers over generations from mass selection among the plants available in their own and neighboring fields. It requires a relatively long growing season, and offers low yields compared to varieties selected from the wider genetic variation available elsewhere.

Over the past 50 years, landrace peanut varieties have been gradually replaced mainly by an early-maturing variety from China known as *Shitaochi* and a slower but potentially high-yielding variety from Zambia known as *Mani Pintar.* These were introduced in 1960 at the start of Ghana's independence. Subsequently, researchers on local experiment stations have since found better performing varieties, including *Sinkarzie* and *F-mix* that are both late-maturing varieties released in the 1980s. Farm surveys reveal that the Chinese and Mani Pintar varieties remain the most widely cultivated (24) and many isolated farmers continue to plant ancestral landraces due to the difficulty of obtaining improved seeds (25).

Decades after their introduction, improved varieties continue to spread slowly by exchange among farmers. Each peanut plant produces relatively few nuts, which farmers apportion between what they sell, consume or use as seed. The crop is self-pollinating so seeds generally remain viable, but compared to cereal grains which may also be stored, a relatively larger share of the harvest must be set aside by each farmer just to replant their own fields, let alone give or sell to others. Large-scale multiplication is possible but not commercially viable, as any venture would be able to sell new seeds only once since customers could replant their own harvest thereafter.

Like most peanuts in Africa, Ghana's crop is produced almost entirely without irrigation and with few soil amendments. The table below summarizes the area, yield levels and environmental characteristics of peanut production in main growing regions.

The larger Northern Region now dominates total production, with an estimated five-fold expansion from 40,000 to over 200,000 mt over a decade, followed by the Upper West Region that almost doubled from 68,000 to 124,000, displacing production from the Upper East Region which is estimated to have declined from 100,000 to 86,600 mt. That shift may be partly attributable to intermittent ethnic conflicts in the Upper East Region, although the Northern Region's relatively better market access may also have played a role.

Table 4: Peanut production by major region, 2000-2010

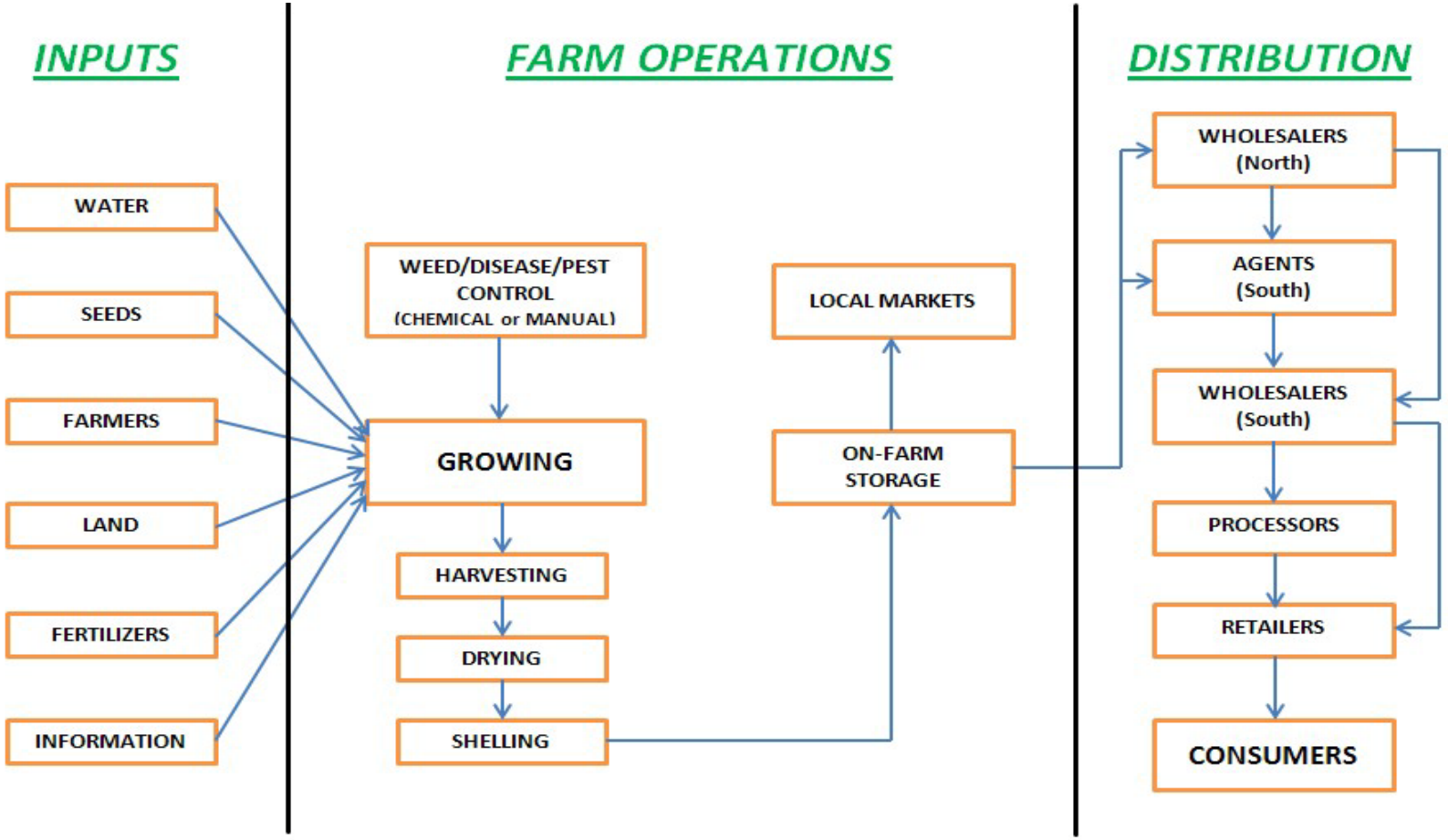
	Northern Region			Upper East Region			Upper West Region		
	2000	2002	2010	2000	2002	2010	2000	2002	2010
Annual output (mt)	40,000	130,000	227,652	100,015	150,000	86,613	68,623	120,000	124,041
Average growth in output (2000-2010) (% per year)		46.9			-1.34			8.08	
Area under cultivation (ha)	60,000	90,000		109,426	120,000		48,434	85,000	
Yield (mt/ha)	0.67	1.44		0.91	1.25		1.42	1.41	
Annual rainfall (mm)		1,100			898			1,059	
Soil characteristics									
pH		4.5-6.7			5.1-6.8			6.0-6.8	
Organic Matter (%)		0.6-2.0			1.1-2.5			0.5-1.3	
Total Nitrogen (g/kg)		0.02-0.05			0.06-0.14			0.01-0.07	
Phosphorus (mg/kg)		2.5-10.0			1.75-14.75			2.0-7.4	
Calcium (mg/kg)		45-90			43.5-151.5			52-151.5	

Note: Almost all of the Northern Region in the Guinea Savannah agro-ecological zone, whereas the Upper East and Upper West Regions are primarily in the Sudan Savannah zone.
Source: Output and Acreage, MoFA 2000, 2002, 2010

The country's estimated peanut yield level of around 1.4 mt/ha is close to the world average, in between the African and Asian averages of about 1 and 2 mt/ha respectively. The United States average yield levels of about 3.5 mt/ha could potentially be reached in Ghana with more locally-adapted new varieties, irrigation, soil amendments and crop protection from pests and diseases, but the purchased inputs needed are either unavailable or prohibitively expensive to use, given the availability of peanuts produced with traditional methods using only northern Ghana's relatively abundant farm land and labor.

The current value chain for peanuts in Ghana can be illustrated by the figure below, tracing the flow of inputs through production and distribution to final consumption. This report aims to evaluate each link in the chain, so as to identify gaps and constraints that could be overcome with new investments or interventions.

Figure 3: Flow chart of the peanut value chain



Although traditional value-chain analysis focuses narrowly on the specific actors already involved in production and distribution of a particular commodity, in this case we also identify important cross-commodity linkages involving substitution between peanuts and other products. These arise because peanuts are not produced or marketed in isolation, but are embedded in a larger farm and food system. Most notably, we find that the aggregators in northern Ghana who do not currently buy peanuts could potentially be induced to do so, if appropriate procurement and quality assurance techniques were introduced.

Investments and interventions to improve the value chain could target any link in the chain. For peanuts in Ghana, the weakest links for nutrition often involve post-harvest handling and marketing, due to the risk of aflatoxin contamination and other losses. Quality control, together with innovations in transport, storage and processing, could take advantage of relatively abundant cropland and farm labor in northern Ghana to bring nutrient dense products at low cost to the many rural and some urban people at risk of malnutrition.

A important recent study funded by UKAid(13) identified five criteria for success for any innovation to improve this and other nutritional value chains in Ghana. Their criteria, which we adapt for our purposes here, specify that the impact of a new product or other innovation depends on bringing:

- *Nutritional quality*, increasing the availability of nutrients that are insufficiently consumed by those most vulnerable to malnutrition;
- *Affordability*, providing those nutrients at a cost level within reach of the households most vulnerable to malnutrition;
- *Acceptability*, providing the needed nutrients in a form that can readily be included in the dietary practices of those most vulnerable to malnutrition;
- *Integrity*, offering a mechanism to signal quality and assure consumers regarding the presence of desired ingredients, the absence of contamination, and other traits; and
- *Profitability*, offering a mechanism whereby private investors not only create value for consumers, but can capture enough of that value to cover their costs, based on the enabling environment provided by the public sector.

A variety of peanut-based products can readily meet the first three criteria. Peanuts clearly provide relatively high nutrient density at low cost, in products that are or could be widely consumed by individuals for whom malnutrition is now widespread. The constraints on peanut value chain development arise primarily in terms of integrity and profitability, due to the high cost and difficulty of regularly obtaining sufficient volumes of consistently high quality.

The current peanut value chain in Ghana is based on spot purchases by wholesalers in open markets, where prices fluctuate and quality is variable. There is almost no traceability from end-users back through wholesalers to the location of production, and very little incentive for farmers, transporters and traders to upgrade practices to improve

quality. The Somuah-Anim et al. report notes that "there are no known cases of value chain actors developing traceable supply chains for groundnuts or of direct relationships between food processors and producers". Indeed, the report finds that processors' access to high-quality peanuts within Ghana is sufficiently limited that Burger Food Industries, maker of the country's popular Nkatie Burger flour-coated peanut snack, diversifies its sourcing from across the West Africa region including Burkina Faso, Mali and Senegal as well as Ghana.(13)

5. Constraints and opportunities

Peanuts in northern Ghana offer an important opportunity to improve livelihoods and nutrition, but building a commercial value chain is subject to important constraints. This section provides a detailed assessment of how peanuts are grown and marketed, so as to identify the most promising opportunities and constraints.

5.1 Peanut production and input use

Peanuts are a deep-rooting, nitrogen-fixing legume, well adapted to rainfed conditions in sandy soils such as the of northern savannah regions of Ghana. The crop generally matures after 90-120 days, depending on variety. Slower maturation can bring higher yields but only if soils remain moist, so shorter-season varieties are needed to adapt to late onset and early cessation of rains.

Natural constraints other than agro-climatic zone also influence farmers' peanut production and market potential including soil structure and chemistry, pest and disease pressure and competition from weeds (26). As in most African peanut production systems, the use of purchased inputs is extremely limited. Production is driven by the use of relatively abundant farm labor, with the main purchased input used by those farmers who have larger land areas being weedicides and pesticides for crop protection.

Government policies and institutions that influence the availability of inputs and the growth of markets are somewhat decentralized in Ghana, which has ten administrative regions. Each plans its own developmental agenda to some degree. In northern Ghana, the national government has also established the Savannah Accelerated Development Authority (SADA) whose goal is to promote technology transfer and market development. The success of any new investment or intervention will depend in part on public sector support, taking account of the many specific constraints and opportunities in the peanut value chain of northern Ghana as detailed below.

Farmers

The most important input for peanut farming is farmers' own skill and energy. Without their willingness, knowledge, and labor there would not be a cultivated crop of any kind in the region. Using the 2000 Population and Housing Census, the Ghana Ministry of Food

and Agriculture estimated that there were 941,955 "economically active" people between the ages of 15 and 50 in the three northern regions who were engaged in agriculture (defined as farming, forestry, fishing, and hunting). The recently released 2010 Census does not contain a similar breakdown as yet, but with the population in the northern regions only growing by about 50,000 people (1.2%) between the 2000 and 2010 counts, it can be assumed that total pool of potential peanut farmers in the region is just less than a million individuals.

A 2010 survey of 251 northern peanut farmers found an average household size of 13 persons spanning several generations, cultivating an average of about 4 hectares of peanuts out of the total 9 acres that they farmed. Thirty four percent of respondents reported having income from off-farm activities and 54% reported hiring farm labor during 2009. Eighty five percent had no formal education (24). Literacy rates for all people ages 15+ in the three northern peanut producing regions are 33%, 41%, and 40%, and formal training for farming is virtually nonexistent and farm practices are mostly handed down from generation to generation (15). Access to electricity in the three primary peanut growing areas averages only 30% of the households and only about 25% of households have toilet facilities (15).

The Ministry of Food and Agriculture calculates that with a gross 2010 peanut harvest of 530,887 mt, and a 10% shelling loss, that the total supply available for that year was 477,904 mt. With a total population of 24.22 million people and an estimated 12kg/person annual consumption, which would mean that total domestic production of peanuts would be 290,676 mt, resulting in an estimated 187,228 mt surplus. The estimated surplus does not account for any losses that may occur in storage which some have reported to be as high as 70%(20). But the large volumes and rapid recent growth of peanut production suggest that further expansion is possible, if demand were to grow.

Many rural households in the northern region belong to farmer-based organizations (FBOs). The Ministry of Food and Agriculture (MOFA) maintains an online database of several thousand such organizations, which can be focused on a region, a district, or a particular crop. Much of the country's agricultural extension and outreach flows through these FBOs, some of which are large and growing, whereas others are largely inactive. Their diversity could reflect differences in leadership quality and personalities, but also differences in economic opportunities offered to farmer members. Investments that introduce new opportunities could build on FBO system, using them to reach a network of farm suppliers who would otherwise be too dispersed and isolated to reach commercially. Recently, Australia has committed to providing US$1.2 million to build their capacity for such partnerships, with a particular focus on agribusiness and agricultural value chain analysis and management, and post-harvest management. That project is also aimed at strengthening the FBO secretariat within MOFA to improve coordination of FBOs as well as development of capacity of selected apex bodies representing FBOs so they could improve their services to members(27).

Seeds and seed attributes

Farmers growing peanuts have two potential sources of seeds: the informal pool of seeds retained from their previous harvest, purchased from neighboring farmers and through seed exchanges, or the formal sector selling certified seeds that might be available through local agro-dealers and agricultural supply stores (23). Almost all production uses farmers' own retained seed or seeds purchased informally in local markets (28). The resulting seeds are a mixture of improved varieties that have been given local names, sometimes crossed with local seed types.

The National Seed Committee and National Seed Services, agencies that are part of MOFA, operate the formal system for certified seed. In 2011, this channel was estimated to be producing only 0.05% of all peanuts used in the country (29). Some input dealers may have imported additional groundnut seeds from South Africa, Brazil or elsewhere. The total quantity of peanut seed imports is not reported, but it is clear that certified seeds are much less widely used for groundnuts than for other crops. One reason could be that the government subsidizes the cost of certified seeds for maize and rice at an annual cost of GHC 2.6 million, but no such program exists for peanuts (30). Another reason could be the development and dissemination of new varieties is a much lower priority for this than for other crops, as peanuts do not even make it into the list of the top eight crops currently being addressed by government researchers (8).

As described earlier in this report, improved varieties of peanut seeds have been available for decades, but in the absence of large-scale multiplication they have spread slowly around the country. *Shitaochi* and *Mani Pintar*, the varieties introduced from China and Zambia in the 1960s have gradually replaced the local landrace known as *Bulga,* and varieties introduced in the 1980s such as *F-Mix* and *Sinkazie* are being adopted only slowly (26). Several varieties have been released since then, including particularly a set of four early-maturing selections released in 2006 as *Adepa*, *Azivivi*, *Nkosour* and *Jenkaa*. These seed types resulted from the national research service's program of participatory breeding and on-farm trials, and have been described as "agricultural best bets" in the region due to their disease resistance and drought tolerance offering relatively high yields under local conditions (31). The relative performance of these varieties under a variety of conditions has been independently tested showing that for the northern Guinea Savannah zone the Adepa variety is likely to be most successful, whereas Nkosour is better adapted to the Humid Forest zone (32).

Seed availability is limited not only by the breeding of new varieties but also by the pace of seed multiplication. The Adepa variety, for example, yields an average of about 15 seeds per plant so large-scale seed multiplication would require a concerted effort to plant new varieties for seed production rather food consumption. Even before accounting for losses, one acre planted only for seeds would be needed for every 15 acres planted to the new variety in the following year (32).

The table below from IFPRI (2013) shows the number of different peanut varieties reported to be used for such seed production efforts, and the total resulting certified-seed

production in Ghana over the past decade (29). Much of this production is done under contract with small-scale seed growers, often by new seed companies who produce the seeds in response to demand from various public-sector projects. Commercial demand for these seeds is very limited, as farmers would buy them only once and then replant for themselves in subsequent years. As a result, farmers may know about new varieties for years before they can obtain their first samples to try on their own fields.

Table 5: Production of certified peanut seed, 2001-2011

Year	Total Number of Varieties in Seed Production	Total Quantity of Seeds Produced (mt)
2001	-	-
2002	-	-
2003	3	9
2004	1	9
2005	3	63
2006	1	23
2007	2	3
2008	5	7
2009	1	9
2010	2	18
2011	-	-

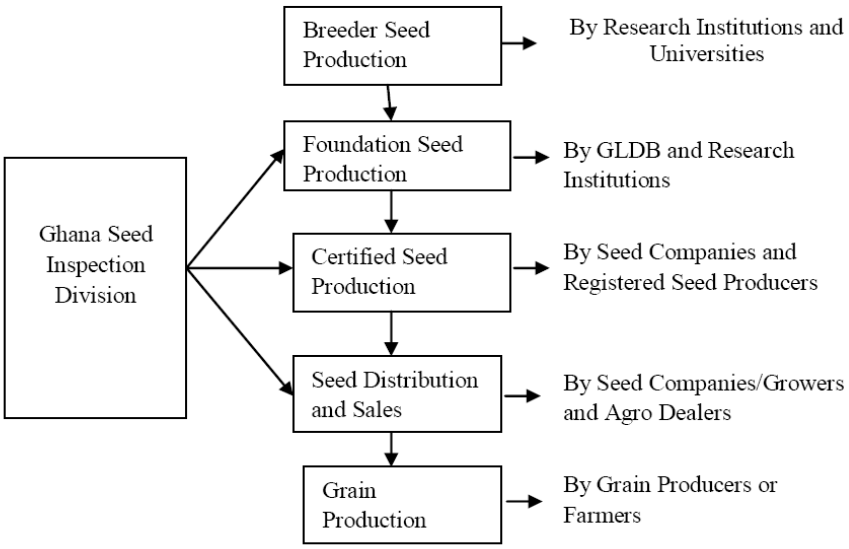
Source: IFPRI (2013): Extracted from Tables 1 &2 (29)

The introduction of a new seed variety follows a five-step process illustrated by the figure below. Selections made by researchers who cross elite material and retain the best varieties results in a stock known as *breeder seed*. In the Ghanaian contest, breeders are employed either on the various experiment stations of the Council for Scientific and Industrial Research (CSIR), or at agricultural universities. They work closely with breeders in other countries to exchange promising material and techniques, often through international agricultural research centers such as ICRISAT and U.S. partners such as the Feed the Future Peanut and Mycotoxin Innovation Lab. The performance of various crosses in local trials is used to identify promising varieties and describe their attributes.

When a desirable variety is registered for release, samples are turned over to Ghana's Grains and Legumes Development Board (GLDB). The GLDB uses that to produce *foundation seed*, which it makes available in limited quantities to registered seed producers. These entities register their intent to multiply that seed for others, and may be commercial companies, non-profit groups or farmers' organizations and aid agencies. Registered seed producers typically seek to produce much more seed than a single farm can grow, so they then contract with numerous farmers to plant their foundation seed and return the harvest for distribution to others as *certified seed*. The distribution of that

final product drives the geographic spread of the new variety, as farmers who buy or receive it can then retain and replant that variety in subsequent years.

Figure 4: Flow chart of the formal seed sector



In Ghana, promising new peanut varieties have been registered but not widely multiplied, because of limited investment in the production of certified seed. That step typically requires contracting between each seed producer and many individual farmers, usually called seed growers. The seed producer provides each contracted grower with foundation seed, and may also provide other inputs or impose cultivation standards in order to ensure that the harvest of certified seeds is of uniform quality. In Ghana today, techniques used by many of the individual seed growers contracted to produce certified seed production are just marginally better than those practiced on ordinary farms. The resulting certified seed is of good quality, but with low seed yields its quantity is limited and seed production is only marginally profitable (29).

The foundation seeds distributed by seed producers to their seed growers are certified by the Ghana Seed Inspection Division of MoFA. A total of only 11 seed producers are now licensed in Ghana, and only four of them are located in the northern regions (33). Together, these entities are represented by the Seed Producers Association of Ghana (SEEDPAG), which has come together to promote the production and marketing of foundation seeds in Ghana.

In the three regions of northern Ghana, the principal seed producer handling peanuts is the Savanna Seed Services Company Limited, which reported producing 1.6 mt of peanut seed in 2010. Other smaller seed producers are also active, in some cases marketing the seed themselves or through agro-dealers. Farmers can also buy imported peanut seeds

from their distributors, and they may receive seeds from public sector projects, either free of charge or under credit arrangements (34).

The development of an effective formal seed system for peanuts is constrained by the public nature of breeder and foundation seed, and the lack of commercial incentive for large-scale distribution of certified seed that farmers will only buy once. In situations where farmers buy fresh seeds every year, seed producers find it profitable to establish the networks of seed growers and agro-dealers needed to spread new varieties (34). But for new varieties of peanuts, the value created by higher yields and better nutrition is retained by the farmer and whoever buys her crop, rather than the seed seller.

Farmers in Ghana and elsewhere often hear about a promising new variety and try it as soon as they can, but may have limited access to new seeds for a variety of reasons. A 2010 survey of 251 peanut farmers in the northern regions found that all of the female farmers had successfully adopted improved varieties, but male farmers who were not members of a farm organization, had fewer assets or were more geographically isolated were more likely to still be planting unimproved seeds. Education, extension visits and household size did not significantly influence variety adoption (24).

The attributes of a new variety that make it attractive to farmers include its yield level and stability under local agro-climatic conditions, including particularly its pest and disease resistance, drought tolerance and time to maturity. For a given yield, post-harvest attributes such as size, color, taste and texture of the bean, hardness of the shell and quality of the leafy hay residue that is used for livestock feed can also be very important. Furthermore, although all major varieties of peanuts offer high levels of desirable protein, fats and micronutrients, diversity in their nutritional profiles may influence which variety is appropriate for a specific purpose.

For example, a 2008 study entitled "Evaluation of Nutritional Quality of Groundnut from Ghana" evaluated the nutritional content of 20 different varieties and found various quality attributes that can be selected from according to the intended use. If long shelf life is required it may be beneficial to choose Dagomba, Nkate kokoo and Sinkazie because of their high oleic/linoleic ratios. When products with high protein meal are required, Kamalloo, Kowoka, and Afu may be useful. Groundnuts produced mainly for their flavor and taste may use Sinkazie or F-mix because of their high soluble sugar content. Species hypogaea has better oil content and O/L ratio but their long duration in the field makes them unpopular among farmers because of erratic rainfall patterns (35). For most purposes these differences are not very large, however, so yield levels and stability under farmers' conditions plus palatability of the bean are the principal factors influencing how successful peanut production will be.

Review of nutritional value of different seed varieties indicates differences in physical and nutritional characteristics (36, 37). Frimpong et al (2007) have reported variation in protein and fat content with the protein content 14 tested varieties ranging from 25.6% to 29.6%. Varieties CSTV404MB and CS-49 had high protein contents and moderately

high oil contents and Frimpong et al (2007) recommended these varieties for oil extraction and protein supplementation of local diets low in protein. Eshun (2009) analyzed groundnut flour prepared from five groundnut varieties including the Sinkarzie, F-mix, JL 24, Chinese and Manipintar. The author found that the moisture contents of the groundnut varieties ranged from 4.46 % in Chinese to 8.99 % in F-mix, these differences were statistically significant at the 0.05 level. On the other hand, crude protein values for the five groundnut varieties ranged from 23.53 % in Chinese to 28.88 % in JL 24 with Sinkarzie (23.62%) and Chinese (23.53%) being the lowest and significantly different from the other groundnut varieties. Crude fat was highest in Sinkarzie (48.79 %), and lowest in JL 24 (38.11 %) with all five groundnut varieties were significantly different ($p < 0.05$) in their crude fat contents (37).

Field Preparation

In northern Ghana, peanuts are grown both in pure stands and in intercrops with maize and other cereals. The crop is established mostly by hand-hoe or bullock plowing, on ridges and mounds that may be either planted in rows or staggered across the field. Field preparation is done using tractors only on the largest commercial farms(23). In most instances, no forms of chemicals (fertilizer, weedicides, fungicides, insecticides) are used in production (38). In contrast to cereal grains, peanuts and other leguminous crops such as soybeans typically grow in symbiotic association with nitrogen-fixing *rhizobia* and *mycorrhizae.* These soil micro-organisms provide a significant naturally-occurring fertilization effect, reducing the need for inorganic nitrogen; they are naturally present in many soils, and can also be introduced by inoculating seeds (69).

Land and soil fertility

In northern Ghana, the availability of suitable land has been decreasing over the past decade due to a growing rural population, and the quality of available soils has been declining due to the mining of soil nutrients and erosion. When land was more plentiful, farmers used long fallow periods in which un-harvested plant growth could restore soil nutrients and organic matter. With a rising rural population, shrinking land availability per farmer has forced them to reduce fallow periods and draw down soil nutrients from season to season, often depleting soil organic matter and breaking down soil structure (23).

Cereal crops that draw all of their nitrogen from the soil are particularly likely to deplete and degrade soils. Some regeneration is possible with crop rotation such as maize one season and nitrogen-fixing peanuts the next, especially if crop residues are returned to the field, but net nutrient balances are likely to remain negative if most of the crop is harvested and removed. In some areas, soil mining has gone on so long that cereal cultivation to the point that it may not support economic cereal cultivation, leading farmers to switch to nitrogen-fixing legumes such as groundnuts (23).

As land becomes increasingly scarce and its stock of soil nutrients depleted, farmers' tenure security becomes a critical influence on their incentives to invest in soil improvement (39). Some farmers have legal ownership over the land that they farm, but

many either rent their land, or simply find a suitable area and begin farming it with no formal rights to do so. In those cases where the farmers do not own the land and could lose access to it at any time, they are much less willing to invest in any type of improvements such as fertilization or irrigation systems.

The yield gain from any investment in agronomic improvement depends in part on the initial soil structure and nutrient levels. In northern Ghana, soils are generally shallow and gravely with plinthite and ironstone. They are light textured at the surface, and dry up quickly after rainfalls (23). The soils in the northern region have pH values of 4.5-6.7, organic matter content of 0.6-2.0%, total nitrogen ranging from 0.02-0.05%, available phosphorus varying from 2.5-10.0mg P/kg of soil, and available calcium ranging from 45-90 mg/kg of soil (28). All of these levels are below optimal, but for peanuts a particular concern is low calcium levels that can cause pod rot and low pod fill having a dramatic effect on yield and quality.

Water and irrigation

On average, the northern savannah zone receives 43.3 inches of rain per year during the single rainy season beginning in April/May and ending in September/October (23). This is sufficient water for a healthy peanut crop, but the problem is it does not come slowly and evenly throughout the entire growing season, but rather in intermittent deluges separated by dry periods. Due to the soil composition most of the rain from heavy downpours simply runs off the fields instead of soaking in. Soil organic matter and field-level runoff control is needed to retain moisture in the root zone during the plant's most sensitive periods, which may not always coincide with the natural rainfall pattern.

Irrigation could, of course, provide uniform moisture for optimal plant growth but its use on a large scale for peanuts is unlikely to be economically attractive. Most irrigation is likely to be used for cereals. Peanuts might introduced as a second crop after the cereals are harvested from irrigated areas, but its cost of production could still be higher and volumes more limited than peanuts grown by smallholders in rainfed areas.

Inorganic fertilizers

Chemical fertilizers are available in Ghana and are widely used in the cultivation of high-yielding maize or high-value cash crops such as cocoa and pineapples, but peanut farmers use almost no fertilizers at all due to their relative cost and lack of access (23) and the natural nitrogen-fixing capabilities of leguminous plants. In addition, even if fertilizers were affordable and available, they may actually be detrimental if not applied at the right time and in the correct manner and this type of information and training is not currently available to most peanut farmers. For instance, young peanut plants are very susceptible to fertilizer "burn" and fertilizers should never be applied directly during seeding or after germination.

For all crops in 2009 Ghana imported and used 218,000 mt of fertilizer products. This level of fertilizer intensity is relatively low at 4 kg/ha, in contrast to an estimated 58 kg/ha of nutrients being removed by harvested crops (40). In an effort to assist farmers

and increase fertilizer use, the Ghanaian government actively subsidizes fertilizer imports. It is the only country in the region still doing so, however, and there has been a problem with people buying fertilizer at subsidized prices in Ghana and selling them over the border into unsubsidized markets (41).

For 2013 the MoFA intends to subsidize a total of 180,000 mt of granular fertilizers at a cost of GHC 60M. Six fertilizer companies submitted bids for the government fertilizer subsidy program and would be responsible for clearing the fertilizer at the ports, pay all charges, and deliver allocated quantities to the regions and districts for sale to farmers through registered agents (41). NPK mineral fertilizers are currently selling at GHC 71.5/50kg of which the farmer pays GHC 51.0 and the government absorbs GHC 20.5. Even at the subsidized price, a peanut farmer with a 5 hectare farm would need about 30 bags of fertilizer to apply at the recommended rate which would cost approximately GHC 1,500 and far exceed the income that could be realized from the resulting crop.

Key importers include Yara/Wienco, Chemico, Golden Stork, and Dizengoff and accounted for 95% of all fertilizer imports in 2009. These importers are supported by 20-25 wholesalers and 2700 retailers spread across 107 districts (40). Most of these retailers are concentrated in towns or near peri-urban areas, making it difficult for the smallholders in remote areas to access any of the subsidized fertilizer (40).

Farmers are generally encouraged to use organic fertilizers such as crop residues and cow dung to enrich their fields, but the total quantities available are likely to provide far less nutrients than amounts depleted by current cropping patterns. Crop residues are usually carried off the fields at the end of the rainy season as feed for the farmer's own livestock, or for sale to others for the same purpose. Those left in the fields are consumed by free range cattle or the annual bush fires. In addition, most cattle in northern Ghana do the majority of their grazing in the bush leaving their dung dispersed to dry in the sun, making it very time-consuming to gather and of low nutrient density even if were to be collected. Farmyard manure and compost are important for home gardens and small plots closest to the homestead, but the bulk of national peanut production will continue to be constrained by nutrients available naturally in the soil (23).

Herbicide and pesticide use

Despite very high incidences of plant diseases and insect damage, the usage of herbicide and pesticide is virtually nonexistent likely due to cost, lack of access, and lack of knowledge on how and when to apply them. Surveys revealed high disease incidence and severities of late leaf spot, peanut rust, and peanut rosette.

Severe leaf defoliation (>80) was recorded at most locations during harvest and was associated with poor pod formation (23)(2). Major insect pests include hoppers, millipedes, termites, and white grub however no form of pesticides is used in their control. It has been reported that many farmers are not aware that leaf loss due to foliar diseases are a problem and simply associate it with time to harvest the peanuts. One

study reported that local soaps have been found to be somewhat effective in reducing the occurrence of foliar diseases, but their actual use is unknown at this time (23).

Instead of employing chemical herbicides, the farmers use manual labor to control weeds in the fields during and weed management is the most time consuming and labor intensive activity during the growing season (42).

The cumulative effect of diseases and weeds on the productivity of the peanut farming can be devastating. Pod loss due to leaf spot disease was as high as 78% on-farm, while losses due to rust alone averaged 23% (23). Yield losses due to foliar diseases can be close to 100% in particularly wet years when farmers simply abandon harvesting their crops and can range from 28-50% in years with more moderate rainfall (23).

Mechanization and farm equipment

With the exception of a few instances where some land preparation and shelling are mechanized, the vast majority of farm operations are manual. Tractors are used on large holdings, but these are a small fraction of all farms (23). In President John Dramani Mahama's State of the Nation's address to Parliament on February 21st, 2013 he stated that the "process of modernizing Ghana's agricultural sector involving greater access to tractor services and training of peasant and smallholder farmers on productivity enhancement have resulted in increased harvests of maize, rice, and cassava four the last four straight years. These programs will be expanded with an additional 2,000 tractors, improved seed support, and fertilizer subsidies" (43). SADA announced in May that they will be supporting rice farmers in the Fumbisi Valley by providing tractors, however, no similar efforts were found focusing on peanut farmers (44), and in any case these programs apply only to the very few farmers able to control enough land for machinery to be cost-effective replacements for manual cultivation and animal traction.

A key area of concern is the manual shelling of peanuts. This has implications with respect to efficiency as well as food safety. A NGO called the Full Belly Project based in Wilmington, NC has helped to develop a semi-automated shelling machine using only locally available materials (concrete and bicycle parts) that can shell peanuts at a rate of 50kg/hr. as opposed to the 1kg/hr. that is the norm for hand shelling. Where employed, the machines are very well received by the farmers and thought to represent a real solution to the time consuming task of shell the nuts (45). This could be considered as a possible opportunity in enhancing the efficiency in the peanut value chain, but as with tractors the spread of mechanized shelling is limited by the speed of economic development generally, by which farmers' labor becomes increasingly valuable and they have more capital to invest in labor-saving equipment.

Harvesting

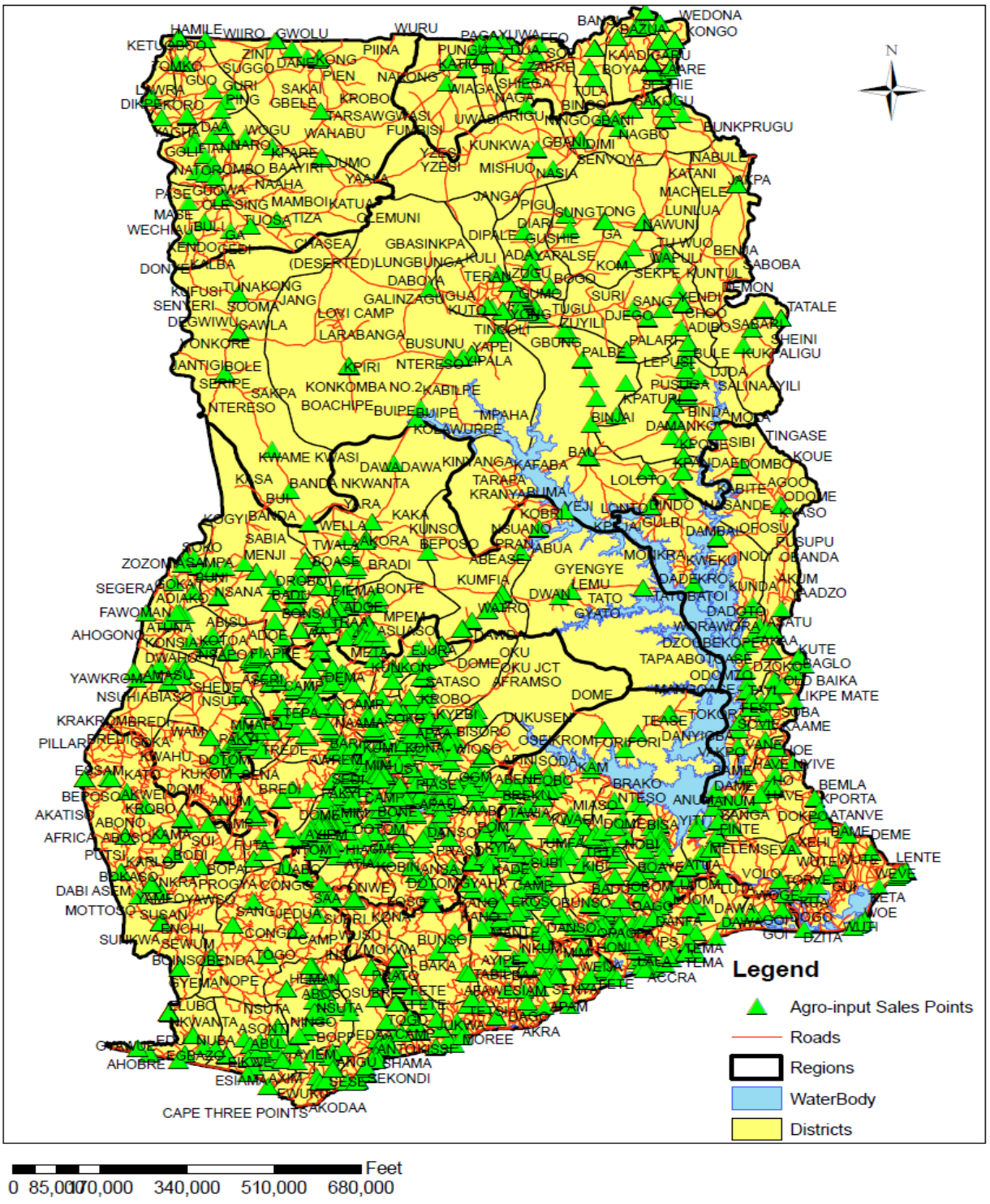
The lack of equipment for harvesting and shelling peanuts makes harvesting laborious, which is one reason why it is widely grown by low-income farmers with few other employment options. Harvesting and plucking are done manually and the peanuts are transported from the fields either by head, donkey cart, or in rare instances, tractors or

trucks (23). If the fields are wet during harvest, the plants can be pulled from the ground manually, but if the fields are dry, the soil becomes very hard and the farmers must use hoes or shovels to extract the plants from the ground. After the vines are uprooted, the services of women are needed to separate the nuts from the vines, assembling them into heaps and transporting them in pans and in sacks to farm houses. The method of hand pulling of peanut results in high pod loss and pod cracking, predisposing the pods to infestation (38). When implements are employed, many of the nuts separate from the vines and remain underground, which reduces the amount harvested.

Sources of purchased inputs

Input used for farming maybe sourced from private sources or through the Ministry of Food and Agriculture. Some unlicensed private sources provides inputs without specification, as well as some modern inputs such as inorganic fertilizer, herbicide, purchased seed, and rented equipment (22). Farmers can get access to input through government institutions such as MOFA that can be effective due to their extended coverage, reach and possibilities of integration with existing government programs. Distribution through NGOs or farmers groups can be an effective way of targeting and distributing inputs to beneficiaries. However, there are several institutional bottlenecks that hinder the effective distribution of farm inputs, including transportation bottlenecks and weak enforcement.

Figure 5: Map of agro-input sales points



Source: IFDC, Ghana Agro-Dealer Development Project (2010)

The geographic distribution of agro-input sales points shows sparse coverage in the less densely populated areas of the Northern Region. It is possible that increased sourcing from these under-served areas could pull agro-dealers into the market, but costs may remain prohibitive with marketed production and inputs use remaining concentrated in the denser regions along transport routes.

Information and outreach

Farmers reported their primary sources of information for learning about and adopting improved cultivation practices to be farmer schools (17%), other farmers (21%), extension and research scientists (55%), and radio (7%) (42). While extension contacts rank among the highest, it is telling that a survey commissioned by the Ghana Peanut Farmers Association found that, on average, there is only one extension agent for every 3,000 farmers, and that in some areas the ratio is as high a 1:7,000 (46). A 2010 survey of peanut farmers in the north found on average each farmer had two contacts with extension officers during the 2009 farming season (24). For religious or moral reasons a section of women smallholder farmers are not comfortable with male extension agents following them to their farms and women agents make up only a small percentage of the agents that there are (46). SADA announced in May that they were partnering with MOFA to increase the number of extension agents by covering the salaries of new agents in the region for the first five years of employment (44). Clearly, different methods of communicating best practices with women farmers should be considered and adjustments made to suit their needs.

The potential for new techniques to have a major impact is illustrated by USAID's Feed the Future program with the Crops Research Institute (CRI) to establish research demonstration plots in various locations. Thirty peanut farmers visited the plots every 2 weeks for training and observation of various production advancements. After three years, the initial 30 farmers are now training other farmers in the region. The effort resulted in dramatic increase in production, doubling of yield, and a significant impact on individual and village finances. It was reported that one farmer recently bought a car, and another a house (42). Of the farmers who attended PCRSP farmer schools 67% reported an increase in area planted, 66% reported increased yields, 64% reported increased consumption, 64% reported an increase in the quantity they sold, and 67% reported increased incomes (42). Finatrade Foundation announced in May that they were making available GHC 200,000 for the expansion of model farms of the University of Ghana, Legon and Kwame Nkrumah University of Science and Technology.

Information on agricultural conditions and the performance of new techniques is much needed to guide outreach and training efforts. In April 2013, the USAID-funded ADVANCE project with the Center for Remote Sensing and Geographic Information Services (CERGIS) at the University of Ghana launched a website (www.gis4ghagric.net) that enables users to explore data on crop farms, production volumes, agricultural commerce, agricultural facilities, soil characteristics, topography, climate conditions, and cover/land use, crop/land suitability, socio-economic indicators, etc. (47).

While various innovations have been demonstrated to offer increased productivity for peanut farmers, and multiple efforts have been made by public and private organizations to communicate these results, the gains that can be achieved are limited by the degree to which these changes actually meet farmers' own perceived needs (48). The adoption of new technology (i.e., better crop varieties) has been linked to risk, uncertainty, input rationing, information imperfections, human capital and social networks (49-51). It is important to realize that higher yields are rarely achieved by any one change alone, but rather by a combination or sequence of changes addressing the various limiting factors that constrain farm productivity (40).

5.2 Post-harvest handling, storage, and processing

A major influence on the peanut value chain is how farmers handle the crop after harvest, and how marketed peanuts enter any off-farm storage and processing before sale to end-users.

Drying in the shell

Typically, all harvested peanuts are laid out on the ground to dry in the open air. Under northern Ghanaian conditions, enclosed drying would be prohibitively costly, but without stronger incentives to protect the area, drying nuts are often left exposed to dirt, dust, vermin, and insects (23). Although October and November are the hottest and driest months of the year in northern Ghana, the occasional late season rain shower can also rewet the exposed nuts if they are not removed from the ground on time. Effective drying is critical to the control of mold growth in storage. The target moisture levels are less than 7% in the shell, and less than 9% for shelled nuts, but unless farmers have a clear incentive to reach these moisture levels they may choose to sell that are still moist. Integrity of the shell is also important to protect nuts from fungal contamination and the resulting mycotoxins, and farmers may have an incentive to sell nuts in damaged shells that they suspect are more likely to be contaminated with aflatoxin, as shown recently for maize in Kenya (52). Since farmers can readily observe the approximate moisture levels and shell integrity of their dried peanuts, detecting and controlling mycotoxin contamination is most cost-effectively done on farm prior to sale. Once taken off the farm, the next lowest-cost approach to detecting contaminated nuts is with ultraviolet light. Aflatoxins are naturally fluorescent under UV light at wavelengths around 350 nm, permitting bulk scanning of peanuts at lower cost than biochemical testing of selected samples (70, 71, 72), but this is not yet practiced in Ghana due to the lack of incentives for aflatoxin-free products.

Shelling

Shelling the dried peanuts is done mainly by hand and on a very limited scale by the use of manually operated crude machinery. Manual shelling of peanuts yields an average of 1kg/ person/hour(45). As noted in the section "Mechanization and Farm Equipment", the Peanut and Mycotoxin Innovation Lab researchers in conjunction with the non-profit Full Belly Project have recently developed a manually operated peanut shelling machine

using only locally available materials (concrete and bicycle parts) that increased shelling rates to 50kg/hr with only a 5% breakage rate which was deemed acceptable (45), as lower levels of breakage are essential to protect the seed from fungal infection during storage (72). Hand-shelling remains the norm, however, in Northern Ghana and other settings where farmers' cost of labor remains low relative to their cost of capital and machinery. As farmers accumulate capital, and employment or schooling opportunities improve especially for girls and women, farm households become more willing and able to invest in labor-saving machinery, but it is not yet clear for what fraction of peanut growers even an improved machine can compete with traditional hand operations.

Storage

A number of different containers have been observed being used to store shelled peanuts on farms including clay pots, gourds, mud silos, jute sacks, plastic bags, plastic drums, and glass bottles. The most prevalent container appears to be jute bags. Rarely are steps taken to clean the bags before use or make sure they are not already infected with mold spores (53). The bagged peanuts are stored in the farmer's home, or in specially constructed structures made from thatch (23). A study of farming practices in Benin found that of the 90 farmers surveyed they reported that they stored their crop for up to 6 months depending on market conditions, that 95% dried their peanuts before storage, but that only 10% sorted their peanuts to remove shriveled or discolored kernels indicative of aflatoxin infection because of the loss of yield (approximately 5%-15%) and increased labor in doing so (54). Improving storage will depend in large part on farmers' incentives to handle the peanuts more carefully, in response to market opportunities.

On-farm Processing

A certain portion of the kernels kept by the farmers are pressed in the home for the extraction of the vegetable oil which is a major source of income for rural women (23). The pressed peanut meal left behind is used as an ingredient in many other dishes prepared in the home.

5.3 Aflatoxin levels and control options

A central issue for post-harvest handling and processing of peanuts is the potential for fungal infection and mycotoxin contamination, particularly aflatoxins. No data are available on aflatoxin levels in peanut-containing foods consumed by the farmers themselves, but 70 samples of marketed peanut products were purchased and tested in 2010 for IFPRI's Ghana Strategy Support Program. The results, published in June 2013 and shown in the table below, revealed large differences in contamination levels. Some products were virtually aflatoxin-free, but others were well above the limits used by various food safety agencies, which range from 4 ppb for processed peanut products in the EU, to 20 ppb in Ghana and in the United States.

Given the small number of samples tested it is difficult to generalize from the observed patterns, other than to note that older peanuts and those in damaged shells had higher contamination levels, as did some of the most processed products. For example, Kulikuli

(a snack food made of fried peanut paste) the samples of Tom Brown (a Ghanaian term for composite flour used for porridge, based historically on the corn-soy blend introduced as food aid but now made locally with corn and roasted soy or peanuts), and one of the two Uni-Mix samples (a product similar to Tom Brown) all had very high contamination levels. Some of the highly processed products had low contamination levels, however, notably the samples of Dawadawa (a condiment typically prepared from fermented locust bean seeds), Nkati cake or Dakwa (snack products made from peanuts and other ingredients), as well as the Crispy Nut Cracker and the Burger peanut snacks.

Table 6: Aflatoxin levels in selected peanut products, 2010

Type of product	Average total aflatoxin content (ppb)
Raw peanuts	
New crop	1.7
In shell	7.6
Unknown crop	8.6
Old crop	88.8
Rejects	288.8
Cottage industry processed products	
Roasted peanuts	1.0
Dawadawa	2.9
Nkati cake	7.6
Dakwa	10.9
Pounded raw peanut	15.8
Paste	52.6
Kulikuli	76.9
Manufactured groundnut products	
Crispy Nut Cracker	1.1
Uni-mix (product #1)	1.9
Burger®	5.0
Tom Brown	104.0
Uni-mix (product #2)	296.0

Source: Extracted from Figures 1, 2 and 3 of W.J. Florkowski and S. Kolavalli, Aflatoxin control strategies in the groundnut value chain in Ghana. Accra: IFPRI, June 2013. (19)

The high level of aflatoxin observed in many products is not inevitable. Even with local post-harvest handling techniques, Northern Ghana's climatic conditions allow farmers to thoroughly dry their grains and legumes before storage. Nonetheless, the danger that poor handling will lead to aflatoxin contamination has inhibited the development of Ghana's peanut market that might otherwise have taken advantage of the region's production potential.

Aflatoxin control measures are a very active subject of on-going research in Africa and elsewhere, with efforts such as the Partnership for Aflatoxin Control in Africa

(www.aflatoxinpartnership.org). One prominent and perhaps promising approach involves biocontrol, having farmers seed their fields with non-toxic strains of the *Aspergillus* fungus which can then replace the naturally-occuring toxic strains. This approach, known as Aflasafe, is being assessed through ongoing trials in Nigeria where the non-toxic varieties of fungus were found (www.aflasafe.com). The more established methods of control involve preventing fungal infection in the first place, by preserving the peanut's protective shell intact as it dries, and then keeping the dried nuts protected in bags or other containers until processing and consumption occurs.

To control aflatoxin using the standard approach of careful postharvest handling and drying, buyers would have to be able to discern and reject contaminated peanuts, or pay a premium for aflatoxin-free deliveries. For aflatoxin, as for other potential food safety hazards, allowable contamination levels are specified in various regulations that may or may not be enforced, if only because detection is limited by the cost and feasibility of testing. Foods considered to be uncontaminated may have varying levels of various toxins below the thresholds that are observable, or they may be observable but below the maximum levels allowed by the buyer. For aflatoxins, purchasers' regulations vary not only in the degree of enforcement, but also in what they allow, ranging for example from 20 ppb of total aflatoxins in the United States to 5 ppb of specific aflatoxins in Europe; to the extent that Ghana's rules are enforced, they specify the US limit of 20 ppb below which a product could be considered "aflatoxin-free".

Buyers, and particularly aggregators who bulk up wholesale shipments, are therefore in a unique position to introduce aflatoxin control measures and quality assurance procedures. They drive production practices by offering market access, which is a very scarce resource in northern Ghana. Farmers have shown a clear willingness and ability to comply with customer specifications by adopting technologies that aggregators demand, if the potential purchasers anticipate farmers' need for credit, training and other enabling services. Some aggregators are making these investments, but such contract buying and outgrower schemes require careful planning to pull farmers along a new technological pathway towards larger volumes, higher and more uniform quality, and adherence to good agricultural practices.

One approach to preventing aflatoxin growth in stored grains or nuts is to provide farmers with bags capable of being hermetically sealed. As long as these bags remain sealed, the fungi or other organisms present grow only until they have exhausted the residual oxygen inside the bag at the time of closure. From then on, further growth stops and the grain can be stored with minimal additional losses until the bag is opened. This technique was introduced to Ghana for storage of cowpeas, which are particularly vulnerable to insect damage. Two kinds of hermetic-storage bags have been introduced for agricultural use in Africa: the Purdue Improved Cowpea Storage system (http://ag.purdue.edu/ipia/pics) sold under trademark protection, and the "ultra-hermetic" bags produced under patent by a US company (www.grainpro.com). Both are widely seen as effective ways to limit growth of various pests in stored grain, and aggregators note that it can be used successfully for peanuts to control

aflatoxin as well. But for aflatoxin control, aggregators argue that the groundnuts must be well dried and not cracked prior to sealing the bag, and if that is done then under northern Ghanaian conditions there is limited danger of further aflatoxin contamination even with ordinary bags.

The simpler, traditional approach to aflatoxin control is to have farmers keep groundnuts in their shells after drying, so that the nuts remain protected during storage and transit. In Ghana today this is not normally done, for three main reasons: (a) shelling of groundnuts is difficult to mechanize, and self-employed farmers can do this operation at low cost in the off season, (b) nuts in their shells are bulky, and therefore harder to transport and store than shelled nuts; and (c) traders need to inspect each lot before purchase, which is easier to do after the nuts are shelled. Buyers can use new technologies to overcome all of these constraints, however, with mechanical shellers and UV lights to detect aflatoxins on the outside of shells.

A preferred option for aflatoxin control in the context of northern Ghana is likely to be for aggregators to buy nuts in their shells, and then use their own mechanical shellers before shipping the peanuts to their final purchaser. Such aggregators could use visual inspection to look for broken shells and UV lights to scan for fungal infection, and then reject contaminated shipments. To reduce the cost of inspection, aggregators could also adopt a contract buying approach, in which the buyer sends agents to visit farmers in an effort to ensure good agricultural practices, in this case especially for post-harvest handling to keep their peanut shells intact and dry. This approach is the simplest and closest to current practices. It amounts to scaling up the way in which farms currently sell their peanuts, and extending to peanuts the way in which the World Food Program's Purchase for Progress (P4P) and others currently buy maize, rice and soyabeans.

5.4 Consumption and markets

Common uses and preparation methods

The Ministry of Food and Agriculture reports show that Ghanaians consume on average 12 kg (26.45 lbs.) of peanuts per year compared to 6.4 lbs. which is the current US per capita consumption of all peanut products. The national per capita availability of total energy, protein and fat from peanut consumption is presented in Table 2 but it is likely that residents in the peanut farming regions, and peanut farmers in particular, may consume even more than the national average.

As noted earlier, peanuts serve as a major source of total energy, protein, fat and certain essential vitamins and minerals and are used extensively in many dishes both on the farms and in the larger towns and cities. Roasted peanuts are eaten as a snack and peanut butter is used extensively as an ingredient in many dishes such as soup and stews (55) Consumption is typically seasonal, as in the north the months of April to July are the

lean season when stored stocks from the previous growing year may be running low and new crops have yet to become available (15).

Illustrative quantities produced, sold, consumed and used for seed

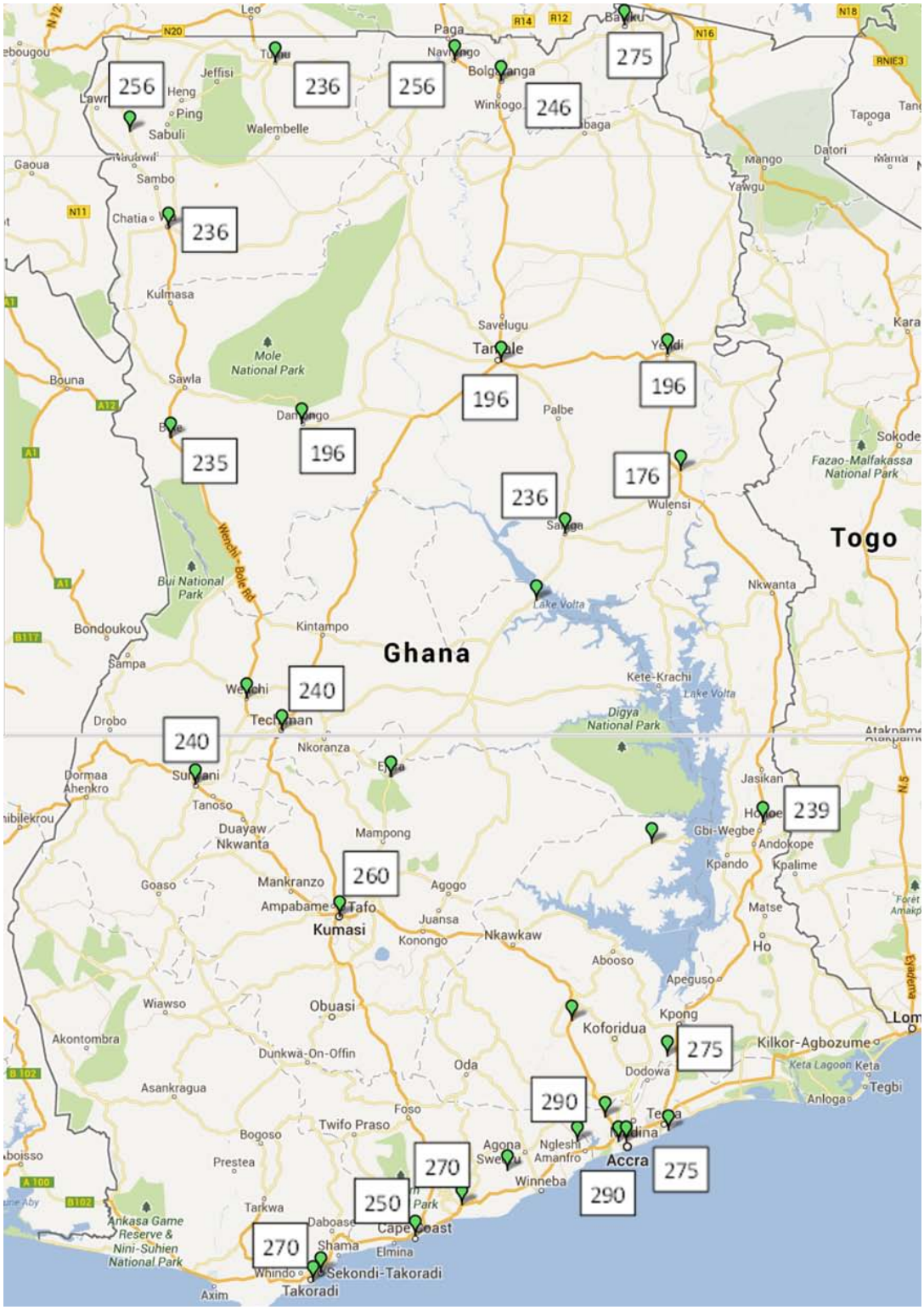
It has been estimated that around 70% of farmers who grow peanuts sell some of their crop to generate cash, however there were no statistics found to indicate the percentage retained versus sold. It seems likely that the percentages may vary from season to season based on the amount harvested which can vary widely based on rainfall, pest infestations, and other factors.

One way to appreciate the magnitudes involved is to compute quantities that might be produced, sold, consumed on farm and used for seed by illustrative household. For example, if a household of 13 individuals consumes the reported per capita figure of 12 kg per person, then total household consumption would be 156 kg (345 lbs.) per year. A peanut producer for whom the crop is relatively abundant might, as outer limit, consume twice the reported national average, totaling 312 kg (690 lbs.) per year. With the average farmer cultivating 4 hectares of peanuts at an average yield of 1.5 mt/ha, then they might produce 6 mt (6,000 kg) in a normal season. Thus a peanut household would need to retain approximately 5% of their crop for home consumption, and at standard seed rates an additional 12% of the crop for re-seeding, allowing them to sell 83% of the crop to others.

Wholesale and retail pricing

Market prices of farm commodities in Ghana are reported regularly on esoko.com. For example, in the week ending May 17, 2013 they reported an average wholesale price of shelled groundnuts as GHC 3.44/kg, and average retail price as GHC3.55/kg. Both wholesale and retail prices are reported for various locations around the country and show approximately a GHC 1.1 higher price for groundnuts in southern markets (Accra & Takoradi) over markets in the north (Tamale and Bawku) (56). Trade between the north and the south does not occur continuously, however, so the price gap between them does not always reflect transport costs. For example, an analysis of peanut price transmission in Ghana between 2004 and 2006 showed that the northern and southern peanut markets are not consistently integrated, perhaps due to poor road networks and poor information and communication technology (57). Examples of current prices are provided in Figure 6, showing prices reported through esoko.com at various dates in August 2013, in Ghana cedis per 82 kg bag of shelled peanuts. These prices reveal clearly the typical pattern of lower prices in the northern region around Tamale, and also show market prices in the far north of the country that are almost as high as those in the south around Accra.

Figure 6: Map of markets and prices for shelled peanuts, August 2013



Source: Adapted from data reported through Esoko.com for various dates in August 2013, in Ghanaian cedis per 82 kg bag of shelled peanuts (http://app.esoko.com)

Access to markets and information

Most smallholder farmers have limited access to formal markets or any information directly from those markets. Farmer's market access and market information comes indirectly through traders and other farmers. In recent years there have been a number of national and internationally sponsored initiatives launched with the express goal of buying from smallholder producers and creating alternative markets for them. For instance, twenty-five farmer-based groups in the Upper West Region have agreed to sell their produce to the Ghana School Feeding Program sponsored by the Ministry of Food and Agriculture (58).

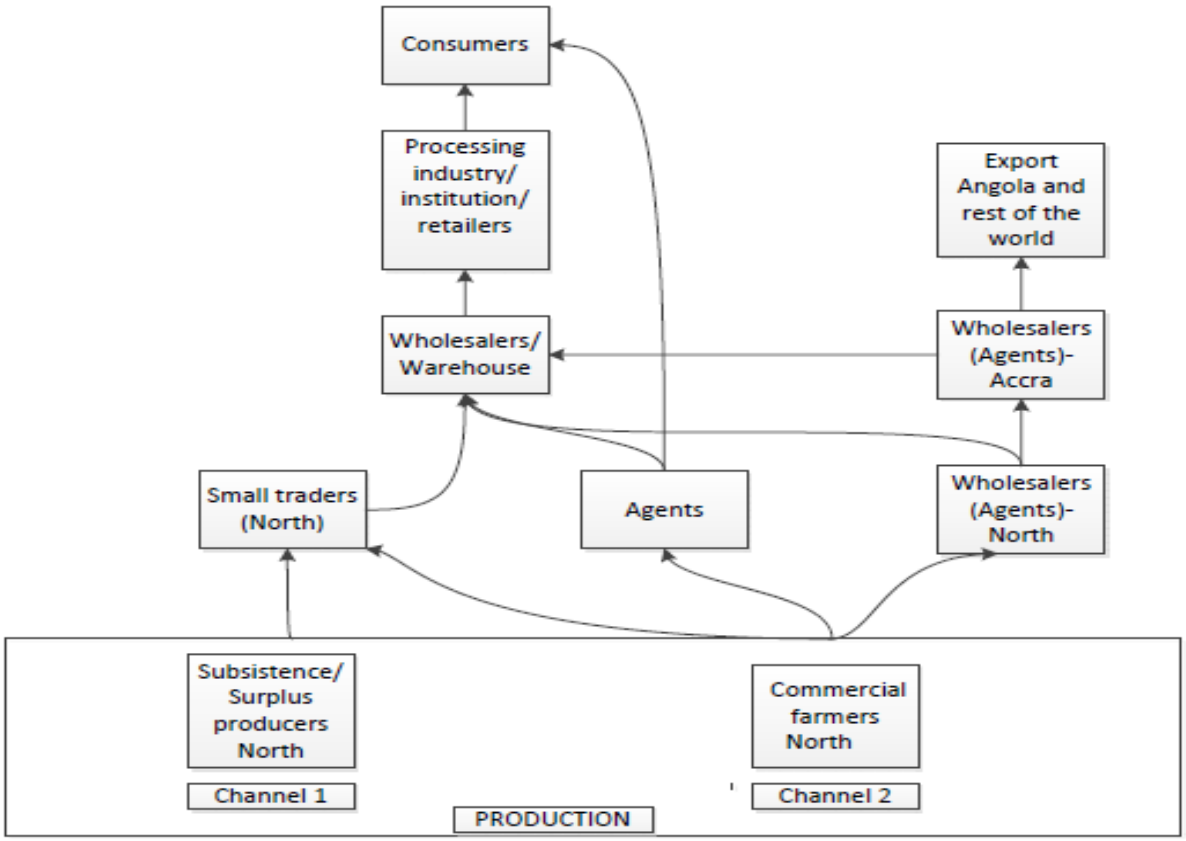
In addition, according to an April 17, 2013 press release, the U.N. World Food Program (WFP) spent USD 300,000 for maize from smallholder farmers in Ghana. The purchase was undertaken through WFP's "Purchase for Progress" initiative (P4P) which is funded by the Canadian International Development Agency (CIDA). The P4P aims to address smallholder issues such as low productivity, difficulties in accessing markets, and inadequate infrastructure. In Ghana, 26 participating farmer groups with a membership of 1,524 farmers have been given hands on training in organizational development, production, post-harvest handling, quality control and assurance, marketing, and other aspects of the value chain. Ten of the farmer groups grow rice and cowpea in the Northern Region, and the remaining 16 grow maize and cowpea in the Ashanti Region (59). It may be possible to work with the sponsors of such programs to have peanuts included in the future.

In summary, Ghanaian peanuts continue to be sold mainly on traditional markets, in which traders rely on reputation and inspection of individual shipments. Peanut is not yet a commodity that is subject to a quality standard in Ghana (discussed in the regulatory section), which would enable significant interchangeable trade. Improved contracting mechanisms could drive change in the marketing and distribution system thereby spurring further growth in the production and nutritious use of this crop and possibly leading to the development of regulatory standards specific to peanuts.

5.5 Distribution and processing

Several actors are identified along the peanut marketing chain playing different but sometimes overlapping roles. A study of the peanut market in Ghana during 2004-2006 found the marketing channels depicted in the figure below (57). The actors involved are categorized as producers, agents/wholesalers who are also the marketers, and finally to the consumer/export markets.

Figure 7: Flow chart of peanut distribution channels



The figure below illustrates the location of main aggregation centers in northern Ghana, and the transportation of the crop to the major consuming areas, mainly the regional capitals in the south.

Figure 8: Map of peanut aggregation and movement

Typical of the production regions, aggregation of peanut are concentrated in the North of Ghana. The Northern Region boasts of some of the major processing companies of peanuts in the country. The northern regions also constitute major consuming places for peanuts. Techiman is a major producing and also a transit market for peanut aggregators, from where peanuts are distributed to Kumasi and to Sekondi-Takoradi and Cape Coast in the coastal regions. Kumasi is also a major aggregation and consuming center of peanuts. Peanuts aggregators also move peanuts directly from the north to Accra for final consumption and processing.

Our fieldwork confirms that the agro-ecological environment of northern Ghana gives that region a comparative advantage in the production of cereal-legume combinations such as maize or rice combined with soybeans or groundnuts. The marketing of these crops, particularly maize and soybeans, has increased in recent years thanks in part to purchases from a few relatively large aggregators. These local NGOs and agribusinesses are not currently buying peanuts, so those are sold through market women, each of whom handles a relatively small volume each year.

Text box: The role of aggregators

The aggregators operating in northern Ghana have diverse business models, with different capacities for farmer training, provision of warehousing facilities, warehousing receipt systems and bulking of produce for processing and marketing. Although individual aggregators, like the small traders, prefer to buy "spot" (pay cash on delivery for products that they inspect before purchase), overwhelmingly the institutional aggregators prefer some form of pre-planting or pre-harvest arrangement. Some of these "contract" purchases actually involve formal contracts for inputs or services provided by the aggregator, but some of them are more informal relationships involving training of farmer groups and formation of a marketing channel for farmers' produce.

For example, SAVBAN is a processing and marketing company in Tamale, formed in 2012 through a partnership between Savannah Farmers Marketing Company (SFMC) and Bandaayili Farmers Union. SFMC had previously worked with peanuts, but stopped doing so in 2005-2006 due to a failed contracting arrangement with an export buyer as well as issues with aflatoxin contamination. SAVBAN's current operations were financed in part by MiDA as an exit strategy for the MCA to help ensure that productivity gains from MCA projects could be sustained commercially. There are 20 farmer organizations working with SAVBAN from the Bandaayili Farmers Union. These organizations have an average of about 50 members for a total of 1,000 farm households who can sell to SAVBAN, which reports employing 4 permanent staff and 7 casual laborers. They deal in 3 main commodities: maize (60%), soybean (30%), and rice (10%), which they purchase from farmers, process and market using facilities with a total storage capacity of 1,000 mt.

Two other aggregators of similar magnitude are AMSIG and the P4P project of WFP. AMSIG, like SAVBAN, received from MiDA to build capacity as an aggregator, warehousing and marketing entity, aiming to provide a one-stop shop for farmers' needs. AMSIG offers credit inputs (mechanization, land preparation; harvesting/post-harvest machinery; support for new technology through demonstration farms to enhance productivity; a warehousing facility with storage capacity of 1,000 mt; cleaning and processing equipment and cost recovery at harvest through buying from farmers at competitive prices.

The P4P project of WFP is about the same total size as SAVBAN and AMSIG, having been able to procure 1,162 mt of maize in 2012 from 13 smallholder/ low income farmer organizations, through which they provided agricultural equipment like rice threshers, rice reapers, grain moisture content testers, tarpaulins, community storage facilities, paddy rice par boilers fuel efficient stoves, weighing scales and poly sack bag stitching machines.

Other NGO or public-private partnerships involved in grains and oilseeds marketing in northern Ghana include the Ghana Grains Council, Action Aid and the ADVANCE project of ACDI/VOCA. Ghana Grain Council, for example, operates a warehouse receipt system for maize, sorghum and rice. They have 18 community-level storage warehouses across the 3 northern regions, each with a capacity of 80 mt. These are linked to larger warehouses of about 500 mt, served by commercial grain traders such as GUNDAA. GGC certifies the identity and ownership of the grain in these larger warehouses, where trained managers monitor the grain.

A variety of grain trading companies have practiced spot buying of peanuts in the past, particularly Ghana Nuts Company in Techiman. They have typically done so through private aggregators. One private trader/aggregator who served this market is BASA Agrobusiness in Tamale, who supplied peanuts to Ghana Nuts on a commission basis, working with 62 agents who have their own farmer bases in the various districts that they buy from. BASA Agrobusiness used funds advanced to him from Ghana Nuts to pre-finance his agents so they could do the spot transactions. The firm was able to supply high volumes of peanuts to Ghana Nuts until Ghana Nuts encountered problems of aflatoxin, as a result of the groundnuts not having been dried adequately before storage.

Commercial Processing of Peanuts

While the desk review for this report was able to identify some companies engaged in mid or large scale further processing of peanuts, their numbers are extremely limited and not readily identified. For example, TradingBIZ.com and Alibaba.com are two of many online directories of businesses worldwide. Searches of those two sites with the key words "Ghana groundnut" and "Ghana peanut" returned a total of 5 companies on TradinBIZ and 4 different companies on Alibaba.com, all of whom listed themselves as exporters and/or producers of peanut oil. Other companies exist but are not listed. For example, Burger Food Industries is a prominent producer of flour-covered peanut snacks called Nkati Burger, but has very little internet presence. Conversely, company named Avnash Industries has a very impressive website that describes their operations in multiple processing plants for a number of commodities including peanuts, but did not appear as a peanut processor in any of the directory searches conducted. Another company reported to have been involved with peanut processing is Patriot Foods, which described it its own publicity as having been founded by an American and "one of the biggest peanut oil and peanut butter processors in Ghana"(60), although there is no supporting evidence for this claim on the ground.

A major development for peanut processing in Ghana was the December 10, 2012 announcement by the Hershey Company that it would partner with the Project Peanut Butter effort to establish a production facility in Ghana that will manufacture peanut based vitamin enriched packets to be distributed to impoverished children in rural Ghana (61). Eventually all the peanuts used in the project will be sourced from within Ghana providing thousands of smallholder peanut farmers with a new market for their crop. The announcement also states that Project Peanut Butter will "work to improve the peanut farming sector by providing farmers with access to higher quality inputs and better planting and harvesting techniques".

Since further processing of peanuts utilizes shelled nuts, there is little waste generated and only one significant byproduct, that is crushed peanut meal left behind after the oil has been extracted. Peanut cake from industrial oil processing is mostly used to feed poultry and livestock, especially in the south (18). This appears to differ from the on-farm practice of oil extraction, from which women use the leftover peanut cake to make foods consumed as snacks (kulikuli) or further processed into powdered form (kulikuli zim) (24). Interviews with University of Georgia Food Science faculty members who have been involved in Ghana for many years indicated deep concerns that the process of removing the oil concentrates any aflatoxin present into the peanut cake potentially increasing the potential for negative nutritional effects. The test results reported in Table 7 support this hypothesis, although only a few samples of any product were tested.(19)

The Ghanaian government has recognized that expansion of the processing sector will benefit not only farmers, but the region as a whole. For instance, SADA has facilitated partnerships to establish three agro-processing factories in the north; a shea butter plant, a rice mill, and a vegetable oil plant (43). Perhaps efforts such as these will include

peanut processing in the future. In April 2013 Haruna Iddrisu, Minister of Industry and Trade, announced that using funds from the renewed Export Development and Investment fund, the government would establish one agribusiness local industry in every district to create employment for youth in rural areas (63).

One recent success story regarding the expansion of processing capacity was described on USAID's Feed the Future website (http//www.feedthefuture.gov) involved a company called Ghana Nuts Ltd. located in Techiman. The company processes and markets tropical nuts and oil seeds such as peanuts, sesame and cashews and was the recipient of a USD 250,000 grant from the U.S. African Development Foundation (USADF) to modernize and expand their factory. Since receiving the grant, the company has become a multi-million dollar company and is now a key player in other Ghanaian value chains, exporting more than 50,000 mt of shea nut and 80,000 mt of soya beans annually to Europe, India, and Japan. The company employs over 1,000 people, which is a tenfold increase from before the grant (62). A cautionary tale regarding their experience with groundnuts, however, is provided in the Annex to this report in the key informant interview with one of their agents, BASA Agrobusiness, who reported having encountered aflatoxin problems associated with purchase of insufficiently dried peanuts in some years.

6. The regulatory environment

Understanding the public-sector enabling environment around the value chain, including legal and institutional arrangements is quite important given its influence on the production and distribution of new products. The following sections include a concise review on government regulations and other policies that affect peanut production as well as an overview of regulatory standards within the peanut value chain.

6.1 Policies affecting production

Agricultural production and value chains are influenced by regulation, but an even more important factor in their development is the provision of public goods that complement private investment. Public services and infrastructure in rural areas make it possible for the private sector to develop competitive businesses, enabling farmers to produce and sell high-quality raw materials. A particularly important aspect of the enabling environment is the provision of new farm technologies to input suppliers. Those technologies are typically developed in the public domain, but then sold to farmers by competing agribusinesses who bulk up and distribute the seeds, fertilizers, chemicals and equipment needed to take advantage of new knowledge about what works best to raise crop yields in any specific location.

For Ghana's peanut value chain, particular constraints include the rural infrastructure and public services needed by farmers in the low-income northern region, especially for

seed multiplication of the varieties already developed for use in peanut-growing areas (64). The government of Ghana is committed to offering a more supportive enabling environment for agricultural gains and nutrition improvement. Ghana has signed on to the Comprehensive Africa Agricultural Development Program (CAADP), which has the goal of eliminating hunger and reducing poverty through agriculture and calls for governments to invest in agricultural development at a minimum level of 10% of their national budgets and raise productivity by 6% per year (55). Nationally, the Ministry of Food and Agriculture in response to the Government's Growth and Poverty Reduction Strategy (GPRS II); MoFA has implemented the Food and Agricultural Sector Development Plan (FASDEP) aimed at pursuing interventions that have the potential to reduce the vulnerability as well as improving the productivity of small producers (55). These two initiatives spurred the creation of the Agricultural Services Sub-Sector Investment Project (AgSSIP) as a means of facilitating agricultural growth and development, in part through the development of Farmer Based Organizations (FBOs) described earlier in this report (65).

In addition to the specific policies related to seed, fertilizer, and agricultural development described above, a number of other government regulations and interventions could potentially impact peanut farming. These include legislation and regulations such as:

- National Irrigation Policy, Strategies and Regulatory Measures, June 2010
- Guidelines for the National Plant Protection Policy, June 2004
- National Water Policy, June 2007
- Environmental Protection Agency Act, 1994, Act 490
- Environmental Assessment Regulations, 1999, LI 1652 and its Amendment
- Plants and Fertilizer Act, 2010, Act 803
- Water Resources Commission Act, 1996, Act 522
- Food and Drugs Act 1992, PNDCL 3058
- Irrigation Development Authority Act, 1977, SMCD 85
- World Bank Safeguard Policy on Pest Management, OP 4.09
- USAID Requirements on Pesticide Management

In reality, the various policies listed above appear to have very little impact on farmers' current practices, due to farmers' relative isolation and non-use of regulated factors, associated with the lack of implementation and enforcement in the region. Regulatory practices can change at any time, however, so any specific new venture should be preceded by appropriate due diligence regarding any potential regulations that might apply to it.

6.2 Inspections and enforcement

As in many other countries, including the United States, the responsibility for assuring food safety in Ghana is spread across several different agencies. For instance, the Ministry of Environment and Sciences is the home of the Ghanaian Environmental Protection Agency (EPA) which regulates the use of fertilizers and pesticides as well as monitoring effluent from processing operations. The Ministry of Food and Agriculture

provides inspection services and certifications for export products, but it is within the Ministry of Health where the Food and Drugs Authority (FDA) is located which has the primary responsibility for assuring the safety of the food supply (USDA, 2009).

The food and drug laws of Ghana where established with the passage of Provisional National Defense Council Law 305B in 1992 (PNDCL 305B) which contained provisions prohibiting the manufacture, and sale of unwholesome, poisonous, or adulterated foods. The act was amended in 1996 to include a provision stating the "food shall be stored and conveyed in such a manner as to preserve its composition, quality, and purity, and minimize the dissipation of its nutritive properties from climatic and other deteriorating conditions." The FDA is currently governed primarily by the country's Public Health Act, Act 851 of 2012, as explained at the FDA's recently-developed website (www.fdaghana.gov.gh).

The FDA fulfills their mission by executing inspections of food processors, testing products, and conducting market surveillance, but those efforts are focused almost entirely on the relatively small fraction of peanuts and other foods that enter the formal, industrial or commercial sector, and largely ignores the informal system through which the majority of food actually moves from producer to consumer in the rural areas outside the major cities. A 2011 study about constraints to the food safety system in Ghana interviewed personnel at the various agencies with food safety responsibilities and concluded that they were hindered by a lack of funding, inadequate logistics, and were grossly under staffed (74).

Sections 18 and 25 of the Ghana food and drug laws (PNDCL 305B) and Section 4(b) of the 1996 amendment to the act has long required that any food products "imported, advertised, sold, or distributed in the country must first be registered with the Food and Drugs Board. The process involves submitting samples of the product(s) to a GFDB laboratory along with an application giving information about the product's ingredients, method of manufacture, name and location of the producer and any other relevant information. The product evaluation by the laboratory can take 2 or 3 months, or even more depending on the volume of products submitted at any given time (73).

In principle, if a food product is evaluated by the FDA as acceptable, then there is a field visit to the manufacturing location(s) to assess sanitary conditions, good handling practices, food safety procedures, and in the case of packaged products, compliance with labeling requirements. Once both the product and place of manufacture are deemed to be acceptable, then a certificate is issued bearing a registration number unique to that product. The product registration is good for three years from the date of issue and the current listed price for the initial registration and each subsequent renewal is GHC500 (approximately $150) per product. The labeling laws do not state that the product registration number must appear on the package or label of a product, but appears that some manufacturers do include it with the other mandatory label elements. A summary of the registration process from the MOFA website is annexed to this report.

In April 2009 Dr. Samuel Sefa-Dedeh, Dean of Engineering Sciences at the University of Ghana, made a presentation to the Go-Global Conference in Accra detailing at length the various food safety regulations and the various government agencies involved in their enforcement (66). In it he describes the Ghanaian food chain as intricate network of middlemen that is "generally not regulated" and with "no traceability". In follow up communications between a contributor to this report and Dr. Sefa-Dedeh, he further opined that the limited government resources that exist for inspection and certifications are more focused on export products in an effort to maintain their compliance with international standards and maintain their reputation in the market, thereby allowing continuing access to them (62). This focus on export products is illustrated by the recent announcement that consumers of locally grown rice will soon be able to identify quality products by a unique certification logo. Although there are existing standards by the Ghana Standards Authority for local rice, they have never been enforced (67). In principle, government regulations require that all crops offered for sale into the commercial market be of "good quality and wholesome", but there is no evidence of any operational inspection system in the field or at major aggregation points.

6.3 Quality standards for aflatoxin

The Ghana Standards Authority (GSA) publishes the Ghana Standards Gazette that has specifications for groundnuts (GS 313:2001), code of practice for the prevention and reduction of aflatoxin contamination in groundnuts (GS 1003:2009), and the determination of aflatoxins in foodstuffs (GS ISO 16050:2003). The options for certification under these standards are detailed in Annex 4 of this report.

The Code of Practice for the prevention and reduction of aflatoxin contamination in groundnuts (GS 1003:2009) provides guidance in the production and handling of groundnuts for entry into international trade for human consumption. All groundnuts (peanuts) should be prepared and handled in accordance with the recommended International Code of Practice-General Principles of Food hygiene, which is relevant for all foods being prepared for human consumption.

The code has two main parts: (a) recommended Good Agricultural Practices (GAP) and, (b) Good Manufacturing Practices (GMP). The GAP recommends guidelines in post-harvest, harvest, transportation, segregation of aflatoxin contaminated lots and storage. The GMP provides guidelines for receiving and shelling, sorting, blanching and the packaging and storage of end products. The code recommends introduction in the future, a complementary management system that incorporates the Hazard Analysis Critical Control Point (HACCP) system in the effort to further reduce levels of Aflatoxin in groundnuts.

Whilst the GS ISO 16050:2003 provides the methods to follow (High-Performance Liquid Chromatographic Method) in the determination of Aflatoxin B1 and the total content of Aflatoxins B1, B2, G1 and G2 in cereals, nuts and derived products, GS 313:2001 provides the quality requirements for groundnuts. The recommended maximum Aflatoxin content

for peanuts in-shell and kernels grade 1-3 are all 20ppb (20µg/kg), although this information is not widely known and at least one source reports a limit of 15 ppb (19). Other characteristics include maximum percentage damaged pods/kernels, as detailed in the table below.

Table 8: Ghana Standards Authority requirements for peanut quality

	Peanuts	Kernels		
Maximum allowable limits	in shell	Grade 1	Grade 2	Grade 3
Extraneous matter content (%)	2	1	3	5
Damaged pods/kernels (%)	0.5	0.5	1.5	3
Shrivelled kernels (%)	3	3	3	3
Skinned kernels (%)	-	0.5	0.5	0.5
Broken and split kernels (%)	-	8	10	12
Empty pods (%)	2	-	-	-
Admixtures of other varieties (%)	5	5	5	5
Aflatoxin content (mcg/kg)	20	20	20	20

Source: (68)

7. Conclusions from the comprehensive assessment

The value chain assessment provided in this report is intended to inform a variety of potential investments and interventions to improve nutrition and livelihoods in Ghana, by improving availability, access and use of peanuts on a commercial scale. The report describes:

4. the current peanut value chain from seed to processing;
5. the public-sector enabling environment around the value chain; and
6. the experience of key informants, including farmers' enterprise budgets.

Taken together, each aspect of the peanut chain poses significant constraints but also offers great opportunities for new peanut-based products to improve nutrition and also promote economic growth. The central feature of these products is to offer nutritionally vulnerable farm households new income-earning opportunities, expanding availability and access to the nutrients in peanuts while protecting consumers from aflatoxin contamination.

Our conclusions can be summarized briefly as follows:

(a) New investments in the peanut value chain can be commercially viable, and provide significant improvements to the livelihoods and nutritional status of farm households in northern Ghana;

(b) The central challenge is to procure large quantities of aflatoxin-free peanuts, which requires development of a new and more secure supply chain in the midst of the larger uncontrolled market;

(c) The most robust new supply chain for aflatoxin-free peanuts is likely to involve aggregators' spot and contract purchases from rainfed smallholder producers, including particularly women farmers, potentially supplemented by other sources such as imports and contracts for production under irrigation;

(d) The most important mycotoxins include aflatoxin and fumonisin. These are known carcinogens and also suppress various aspects of disease immunity and cell function. Aflatoxins are known to cross the placental barrier, and in utero exposure has been shown to impact subsequent infant growth in the first year of life, with two studies in West Africa showing clearly the relationship between aflatoxin exposure and growth retardation;

(e) Building supply for this new value chain will require equipping farmers and aggregators with select new technologies to which they do not yet have access, including improved seed varieties and techniques for aflatoxin control;

(f) The investments and interventions introduced for this innovation are likely to generate significant spillovers benefits for other households producing peanuts for other end-uses, with potentially large gains in livelihoods and nutritional status especially for women and children.

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ANNEXES

1. Peanut farmer profiles and enterprise budgets

For this assessment, Dr. Daniel Sarpong met with 21 peanut-growing farmers from three areas around Tamale Metropolitan Area in the Northern Region: Gushie in Savelugu District, Jimle in the Yendi District, and Kumbungu in the Kumbungu District. The farmers we met are not representative of the entire northern region, but were chosen based on availability for informal interviews at short notice. We found that they can be classified into three broad groups: (a) net food buyers, (b) small net sellers, and (c) large sellers. Among the farmers we interviewed, by far the largest group was the small net sellers, but other two groups are also important and have distinct profiles in production and marketing. We describe these profiles briefly here, before presenting their enterprise budgets.

For all of these farmers, peanut cultivation is relatively tedious and labour intensive, and is used primarily to earn cash. Only peanuts that cannot be sold profitably are consumed on the farm. Seeds are either stored on farm from the previous harvest or purchased from the market, where a preferred seed source is ABAN. There is hardly any intercropping in these areas, as peanuts are planted alone in a small field. In terms of scaling, farmers typically rank peanuts as a secondary crop choice after maize or yam among the starchy staples, and after soyabeans among the legumes. After harvest, the main activities involve drying the peanuts in the sun and storing in barns. Sorting is done by hand and on visual inspection of damaged and cracked seeds. The typical farmer sells shelled nuts at the farm gate to market women. The vines are used as fodder, and shelled residues are typically left on the land.

(a) Net food buyers

The three net food buyer households we interviewed have an average land holding of about 12 acres (5 ha), of which 2 acres (0.8 ha) are in peanuts each year. Over the past three years they reported a mean yield of 270 kg/hectare of shelled nuts.

All of these farmers reported devoting much or all of their family labour to farming, but they had such small total land holdings that they had to sell their higher-value farm products and using any wages they could earn to buy supplementary food. All three of these net-buyer farm households had few assets of any kind, and almost no farm machinery or equipment. They explained that the peak labour requirements and risks involved in any one crop or livestock enterprise lead them to pursue highly diversified cropping patterns.

The typical net food buyer will sell their peanuts immediately after shelling them, and use the money for their urgent cash needs such as school fees etc., or to buy other less expensive foods. They will sell the cracked nuts first, typically 3-4 months after harvest. They typically sell about 70 percent of the harvested peanuts, consuming the rest as food.

(b) Small net sellers

Of the farmers we interviewed, 14 reported that they usually sold somewhat more food than they bought. This group had an average land holding of about 30 acres (12 ha), of which they cultivate an average of 3 acres (1.2 ha) of peanuts per season. They reported a mean yield of 370 kg/ha of shelled nuts.

These producers have sufficient land to produce more food than they consume in most years, and are somewhat more specialized in their cropping patterns than the food buyers. They have no farm machinery or equipment, and use no inorganic fertilizers, but do buy herbicides and also hire labour from neighbouring households to help them control weeds.

They will typically begin to sell their peanuts after December, at the farm gate, selling first the cracked nuts identified by hand sorting using visual inspection to identify damaged and cracked seeds. They typically sell about 80 percent of the harvest peanuts, and use the rest for food, treating their peanuts much like the net food buyers.

(c) Large net sellers

Four farmers that we interviewed considered themselves to be regular sellers of food. They had somewhat less total land than the small net sellers, but had more assets and grew more peanuts. Their average land holding was about 20 acres (8 ha) of which they were planting peanuts on about 4 acres (1.6 ha) per season, and reported a mean yield of 330 mt/ha.

These producers were different from the small net sellers in having more non-land assets of all kinds, including particularly some farm machinery/equipment. The farm machinery was used to alleviate labor constraints at peak times, and their other assets may also help them absorb the risks of each crop enterprise and thereby achieve higher levels of specialization.

These farmers' methods are similar to those of other peanut growers, except that they can afford tractor services for field operations, and they may use mechanical shellers. They typically sell almost all of their produce at once after shelling, typically 5-6 months after harvest.

Enterprise Budgets for Peanut Production and Marketing

The focus of our conversations with farmers was to construct the typical enterprise budgets shown in table 1, reflecting their average experience over the past three years: 2012 which was a relatively good year for most of them, 2011 which was a bad year, and 2010 which was about average year for most of these farmers. Over this time period, we estimate that peanut production was barely profitable for these farmers. Estimated average net returns were around 36-40 Ghanaian cedis (US$17-20) per acre for the net sellers, and around 3.40 GHC (US$1.65) per acre for the net food buyers.

Total costs per acre were roughly similar across the three groups, with the net buyers having the lowest returns because of their lower yields. Yields were highest for the small net seller, but even for them net returns were relatively low both per acre, and as a return on investment at about 25% of total variable cost before deducting the opportunity cost of labor or land.

Table 5: Summary of typical peanut enterprise budgets per acre

		(a) Typical net food buyer (N=3)	(b) Typical small net seller (N=14)	(c) Typical large net seller (N=4)
Total Cost/Acre	**GHC**	160.7	165.3	155.4
Total Revenue/Acre	**GHC**	164.1	206.0	191.7
Net Returns/Acre	**GHC**	3.4	40.7	36.3
Net Returns/Acre	**%**	2.7	28.7	25.1
Average Yield/Acre	**Unshelled Bags**	4.1	5.6	5.0
Yield (kg/acre)	**Shelled**	108.6	148.6	133.4
Yield (mt/acre)	**Shelled**	0.11	0.15	0.13
Yield (mt/ha)	**Shelled**	0.27	0.37	0.33
Price/kg (2010-2012)	**GHC/kg (Shelled)**	1.5	1.5	1.5
Average Exchange rate	**GHC/$**	1.6	1.6	1.6
10% sensitivity analyses on cost over-run				
	% net returns	-7.9	14.6	13.4

Notes: (1) Values are for 3-year averages: 2012 (good year); 2011 (bad year); and 2010 (average year) with equal weights
(2) 1 unshelled bag is approximately 30kg
(3) 3 unshelled bags is approximately 80kg shelled
(4) 1 ha approximately 2.5 acres
(5) Total costs include only variable costs of farm inputs and labor costs

2. Summaries of key informant interviews

To complement our work with farmers and our desk review, Dr. Daniel Sarpong completed 16 interviews with the leaders of major programs and companies involved in Ghana's peanut value chain. We identified these interviews by a snowball sampling, asking each contact to recommend other individuals or organizations they considered to be influential in the sector. Names and contact details are listed below, followed by a summary of the interview results.

Table 6: List of interview subjects and contact details

No.	Contact Person	Position	Organization	Location	Date Inter-viewed	Comments
1	Kris Klokkenga Nathan Heston	Managing Director [resident in Accra]	Africa Atlantic	East Legon—Accra, 0248 078119	August 13, 2013	Farms in the Afram Plain
2	Gina Odarteifio,	CEO	AMSIG	Accra/Tamale, 0244 625646 gina@amsigresources.com	July 5, 2013	
3	Samuel Adjei Hassan	Program Manager, Coordinator Procurement	WFP/P4P	Accra/Tamale, 0541 375723	July 4, 2013	P4P buys grains directly from farmers
4	Collins Boafo	Regional Coordinator (Tamale)	ACDI/VOCA	Tamale, 0577 600370 ckboafo@gmail.com	July 15, 2013	
5	Issahaku M.	Project Officer (Pathways to Secure Livelihoods for Women in Agriculture)	CARE Int. Tamale	Tamale/Accra, 0244 642186 (Albert Kakabo, Regional Coordinator)	July 15, 2013	
6	Joshua Toatoba	Operations Manager (SFMC)	SAVBAN Processing and Marketing Company	Tamale, 0248 778374	July 15, 2013	Aggregation, processing and marketing of grains
7	Janet Adama	Managing Director	Savanna Farmers Marketing Company, Tamale	Tamale, 0244 316758 canjant@gmail.com	July 17, 2013	FBO linkage aggregating peanuts for export
8	Jamail Abdulai	Business Development Officer	Ghana Grains Council	Tamale, 0249 388206	July 15, 2013	Operates warehouse receipt system

No.	Contact Person	Position	Organization	Location	Date Inter-viewed	Comments
9	Mr. Boakye-Acheampong	Regional Director	MoFA	Tamale, 0244 216918	July 16, 2013	
10	Johnson Yoa Pannin	Post Harvest/ Senior Agric Officer	MoFA--Agric Engineering, Accra	Accra, 0208 172110 jypannin@yahoo.co.uk	July 10, 2013	Expert in grain post-harvest management
11	Esther Boateng	Program Manager Northern Region	Action Aid, Tamale	Tamale, 0244 781791 Estherboateng1965@yahoo.com	July 15, 2013	
12	Naresh Shukla	CARD Manager	Centre for Agriculture and Rural Development, Tamale	Tamale, 0244 716849 0208 191360 cardghana@yahoo.com	July 16, 2013	Aggregator, warehousing and marketing
13	Isahaku Zakaria	Advisor , Agriculture	SNV(Netherlands Development Organization)	Tamale, 0209 105146 0245 947056 izakaria@snvworld.org	July 16, 2013	
14	Malex Alebikiya	Executive Director	Association of Church-Based Development NGO's, Tamale (ACDEP)	Tamale, 0244 785305 0209 335574 amalex@acdep.org	July 16, 2013	
15	Edward Martey	Research Scientist (Economics)	Savannah Agriculture Research Institute (SARI)	Tamale, 0242 344450	July 16, 2013	
16	Alhaji Bawa	Trader and Aggregator, Aboabo Market, Tamale	Basa Agro-business	Tamale, 0244 454247	July 17, 2013	Aggregator for Ghana Nuts

AMSIG

Interview date and place: Friday, 05 July 2013 at University of Ghana premises
Interview contact: Mrs Gina Odarteifio, Chief Executive Officer, AMSIG, Tamale
Phone: 0244625646, Email: gina@amsigresources.com.

Company history and business model

1. AMSIG started in 1998, but has gone through transformation. Started as a sole proprietorship, then went into partnership in 2005 and currently a limited liability company since 2010/11. AMSIG has a Mango and Maize plantation in the Damgbe West. That is where the AMSIG started from. When the Millenium Challenge Account (MCC) came, AMSIG went to the Northern Region and the Ashanti Region.
2. AMSIG is a private business entity (Private Limited Liability Company) into agribusiness and believes in creating win-win situations for the firm and smallholders: the firm develops markets for the farmers, and the firm receives produce in the quality and quantity they want. They provide premium price for premium produce.
3. AMSIG has an Agribusiness Centre, which is a one-stop shop for farmers' needs. Depending on what the farmer need, the firm offers credit inputs and recover at harvest, the cost; mechanization, land preparation; harvesting/post-harvest machinery; offer technical support in providing the farmers new technology through demonstration farms to enhance productivity; warehousing facility (1000 mt); processing equipment—cleaners.
4. AMSIG has a turnover of about 1 million Ghana cedis (2012). The firm employs 4 full time persons and contract workers on need basis.
5. On the regulatory framework, not much problems but there have been instances when the Ministry of Food and Agriculture (MoFA) had prevented excess stocks held by the firm from being exported. The premise was that Ghana was not food sufficient yet in the grains to warrant exports. One cannot export unless one has a Phytosanitary Certificate from MoFA.

Perspectives on peanut production

1. Know of aflatoxin in maize but not in peanuts (the firm does not handle peanuts). Several companies are buying the peanuts to process from the North and not heard much on aflatoxin. The CEO knows that aflatoxin has health implications so there is the need to address it.
2. On the role of aggregators, they drive production. Farmers in general complain of lack of access to markets. Aggregators provide that role-creating markets access. Aggregators therefore have a critical role to play in this value chain.
3. Farmers are learning to produce/comply to customer specifications and adopting technologies that allow farmers to produce quality product parameters. Customers (aggregators) facilitate training in a way. Some aggregators pre-finance and invest in the farmers.
4. Farmer success depends on the options available for the farmer. Farmers are now getting assertive and able to negotiate better deals. Farmers can now access

money from microfinance companies and do not now depend solely on the "middleman-aggregator" who usually dictate prices.

5. Large scale farms can have instant results for their supply needs. However, the social impacts can be high. Lands belong to the settlers in the area. Once commercialization starts, people lose their lands. These settlers become farm hands. After a while, the "rise-against" increases and benefits to the large-scale farm could go down. AMSIG believes in "inclusion" based on outgrower schemes.
6. Large scale farms owned by foreigners, must therefore adapt their practices: aggregating 1 ha of 1000 people gives you a 1000 ha through a nucleus-outgrower scheme. The idea is that one should work through groups (groups managed by an aggregator, where the aggregator can reach more but manage less people)

Perspectives on peanut procurement

1. On procurement approaches, the guiding principle is: let your "quality parameters" be known upfront! Spot buying solely is not the best option. Farmers need "interventions" to produce quality produce, hence without these, going in for "any" spot buying can be costly.
2. Farmer contracting is the more cheaper option. AMSIG selected farmer groups in Maize and offered them training. The farmers were supported with production inputs and extension visits. After production, AMSIG takes the produce. Other farmers realizing that the contracted farmers have ready markets, there has been an enhanced farmer to farmer training with more people trying to be part of the chain. With this, AMSIG feels comfortable buying sometimes "on the spot" to augment supply. Quality responsibility is therefore passed on to the farmer.
3. On aflatoxin, on the Northern Region, there is not much of problems with aflatoxin because of the dryness. However, the farmers are always advised not to leave their produce to dry too much. Farmers sometimes provide group labour to harvest at the right time using mechanical shellers. They use storage facilities.
4. On the hermetically-sealed bags, it was tried and the cost/bag was high. Farmers wondered why the cost should be passed on to them. AMSIG met them halfway with the next best alternative. They were provided with Tarpaulins (not free).
5. AMSIG has these interventions because they are interested in the produce they buy. The farmers can handle production up to a point to their ability. If you want the farmer to do more than that, you have to help the farmer by building his/her capacity.
6. AMSIG is now trying to secure 30% of their supplies from their own production by securing land and source the rest from the farmers they deal with. If a firm commits to pick farmers produce, it should do that. Otherwise the whole production system will collapse. There has been several "interventions" that have gotten stuck. Farmers must get the confidence/commitment of what the firm said it will do.
7. On importation of peanuts for any proposed interventions, the simple answer was NO under any circumstance. There may be challenges initially in trying to engage farmers, but over time farmers learn. Get the farmers the capacity building they need.

WORLD FOOD PROGRAMME, PURCHASE FOR PROGRESS (WFP / P4P)

Interview date and place:

July 04, 2013, WFP Premises-Accra. 12.10pm – 1.15pm

Contact person – name, email address and phone numbers

Hassan Abdelrazig: *Co-ordinator*, Purchase for Progress (P4P)
hassan.abdelrazig@wfp.org, hassan.abdelrazig@gmail.com 0544-338-192

Samuel Adjei: *Programme Officer*, P4P
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Firm name and address

World Food Programme (WFP), Purchase for Progress (P4P)
No.7, 7th Rangoon Close, Cantonments, Accra
P.O. Box 1423, Accra

Program history and approach

The Purchase for Progress (P4P) initiative aims to address some of the major constraints which smallholder/low-income Ghanaian farmers face, such as low productivity, high post- harvest losses and poor market infrastructure. P4P programme also aims to promote the development of agricultural markets in such a way that low income/smallholder farmers will produce food surpluses and sell at fair prices to various markets. P4P is working on namely, Capacity Building/Training; Procurement; Partnership and Monitoring/Evaluation and Gender. With respect to Capacity building and training, the sixteen (16) maize producing and ten (10) rice producing Farmer Organizations in the Ashanti and Northern Regions respectively were trained on several farming practices. Under Procurement/Logistics, P4P was able to procure 1,162 mt of maize in 2012 from 13 small holder/low income farmer organizations as well as provide agricultural equipment like rice threshers, rice reapers, grain moisture content testers, tarpaulins, community storage facilities, paddy rice par boilers fuel efficient stoves, weighing Scales and Poly Sack bag stitching machine to the various farmer organization. Also under partnership, P4P participated in the monthly Agricultural Sector Working Group meetings of the MoFA and collaborated with the Ghana Grain Council, ACDI VOCA, Crop Research Institute & Savanna Agric Research Institute, among others, in the training of 26 P4P FOs. Key parameters are:

Duration: October 2010 to September 2015 (5-year pilot programme)

Funding: CIDA – Canadian International Development Agency

Geographical Coverage: Northern Region (1 Metropolis and 2 districts – Tamale Metro, Tolon and Kumbungu districts); and Ashanti region (1 district -Ejura-Sekyedumasi)

Commodities involved: Northern region - Rice and Beans; Ashanti region: Maize and Beans

Target Beneficiaries: Smallholder/Low-income Farmer Organizations (16 Farmer organizations in Ashanti region; and 10 Farmer Organizations in Northern

region) comprising total membership of 1,524 smallholder, low- income farmers of which 48% are women smallholder farmers

Procurement targets: By the end of the pilot in 2015, a total of about 8,600mt of maize and 2,400mt of rice are to be procured by WFP from the P4P targeted smallholder/low-income farmers.). P4P was able to procure 1,162 mt of maize in 2012 from 13 small holder/low income farmer organizations as well as provide agricultural equipment like rice threshers, rice reapers, grain moisture content testers, tarpaulins, community storage facilities, paddy rice par boilers fuel efficient stoves, weighing Scales and Poly Sack bag stitching machine to the various farmer organizations.

Perspectives on Peanut Production

1. The WFP encountered aflatoxin in stored products purchased in 2009 for Niger and Mali. Out of 800 mt about 300 mt had aflatoxin infestation. It was detected then that they were stored in a bad state. Now/Currently what WFP purchase from farmers are relatively free from aflatoxin (WFP <20ppb). The main problem in aflatoxin infestation is harvesting and storage. If not harvested on time and not well dried/stored properly, infestation occurs. The North has a relatively dry weather, so proper training in drying/storage can reduce the infestation.

2. Peanut/groundnut is a leguminous plant so good for agricultural lands in its ability to fix nitrogen. It also thrives well on marginal lands. One can also harvest more peanuts per land than maize. The main challenge is the harvesting and shelling. Without shellers, it has been difficult for farmers to increase acreage. Although peanut is important in the North, lack of shelling machine could reduce output by about 50%. Price fluctuation is a problem due to gluts and scarcities. There is the urgent need to improve post-harvest activities as in Ghana, Mali and Chad among others, peanuts is a major ingredient in foods and consumed widely.

3. Aggregators play key/major roles in pre-financing growers, providing storage facilities, providing training and the marketing of the produce.
   For example, Premier Foods serves as an aggregator and have outgrowers. They provide them with inputs. Outgrowers pay in-kind. Several other companies provide intermediary roles. The company ensures aggregation of products to ensure a recoup of their funds. They also provide markets for the farmers' products.
   There are no minimum guaranteed prices for grains/legumes in Ghana; hence prices are determined mainly through the forces of the market and individual bargaining prowess. The Government do not have the capacity to buy the surplus. Last year, the government announced minimum maize prices but this could not work due to good harvest.

4. Sometimes government actions do not support wholesale buying. This last crop season, there was bumper harvest of grains (maize) and WFP wanted to buy more but government said, No. It is likely that maize may go bad as prices are low now.

A key problem is the lack of enough processing capacity in the country. There is a huge gap between stocking (production) and de-stocking (processing).

5. Large scale farms that are based on "outgrower" schemes are better. Although smallholder farmers are scattered, it is still possible to enhance efficiency based on good "infrastructure". Large scale farms are usually not sustainable based on land litigations, marketing problems. They are very expensive to run because of excessive overheads and other costs. Smallholder outgrower schemes are more sustainable. Large farms operated under outside investors are usually politically challenged: land, financing, etc. These large farms must produce through smallholder farmers by providing training in production as a support to enhance their livelihoods, which is more sustainable. What is more reliable is the outgrower scheme to support the smallholder farmer to control production, quantity and quality of produce. Currently, we see large scale farms with blocks for smallholder farmers: nucleus-outgrower schemes.

Perspectives on Peanut Procurement

1. To control quality of products, you must start from training the farmer. Information on agronomic practices are important. Most processors prefer purchases of peanuts from Northern Ghana than Southern Ghana because of the humidity in the south and the dryness in the north. P4P farmers have being given a lot of training on when to harvest, spacing, when and how to store; simple equipment to test on farm for grains dryness—all which focus on "quality parameters" for the grain. The training ensures the quality P4P wants. If farmers are left on their own, *yes*, procurement and purchase costs will increase. Poor storage could lead to low supply through high spoilage/aflatoxin contamination.

2. There are two models for procurement: Direct negotiations (spot buying) and Farmer Contracting. P4P approach is the Farmer Contracting: discusses with farmers in advance to estimate quantities they can produce, terms on quantities they can sell and price, and delivery times and periods. This approach allows the farmers to produce to meet quality standards as they are assured of market for their produce. In some instances, these farmer groups have used these arrangements as collateral for bank loans! The forward contracting also gives the farmers that assurance of markets for their sustained production. On the issue of discussing with farmers in advance about the "quantities they can sell and price", there is the farmer mentality that is to keep a portion either for food security or to speculate on prices, despite a contract. It is always important to be flexible to let the farmers to then keep in a safe place their "surplus" beyond the agreed contract produce that can be re-purchased when the farmer is ready to sell. The model is that, you must become substantially involved to provide advice/support to the farmers to ensure what you want. Farming is demand driven, when the farmer is not assured of a market they produce other things else.

3. It is also important to adopt a group-collateral system to minimize default in any outgrower scheme. This approach has ensured increased production and the delivery of quality products. One also need the right technical people in peanuts to offer technical advice to the farmers (not merely MoFA extension officers!)

4. In the purchase of raw material, trust is key with the farmers. The P4P has introduced scales/weighing machines for proper weights. P4P enforces grades and standards which are important in the contracts and has helped P4P buy quality produce from the farmers they work with.

5. Hermetically sealed bags are available and tried. However the unit prices are very high. However, it has not been fully accepted by the farmers because of the high unit costs. Anticipates that as demand increases, prices of these bags may come down.

6. P4P caution about the large biomass that are likely to be generated and how to manage this, especially the shells.

ACDEP -- Savanna Farmers Marketing Company

Interview date and place:	July 16, 2013, Tamale
Contact person:	Malex Alebikiya (Executive Director)
Firm name and address:	Association of Church-Based Development NGOs, Tamale 0244785305 amalex@acdep.org

Project history and approach

ACDEP set up the Savanna Farmers Marketing Company. ACDEP established the marketing company to solve the community storage and marketing problem of the produce generated. The ACDEP did not have much capacity then to send the produce to the South to market. The FBOs did not have the marketing experience either and there were problems marketing produce in the south.

Now the focus is on sorghum, soyabeans and maize value chains with IFAD, and with ADVANCE (USAID) moving into other value chains.

On this basis, to move the value chain was to set up an aggregator to handle these. ACDEP/Savanna Farmers Marketing Company became aggregator supplying to other bigger aggregators/buyers such as Premium foods, Yedent company, the Breweries, etc. It also focused on the marketing chain from the farmer level through to the export market. The SFMC was set up to provide inputs, extension, as an aggregator and exporter. At the farmer level, farmers formed FBOs and the profitability of the crops had to characterize the speed of the value chains

Started working on peanuts within an EU Project but was abandoned after 2 years. The reasons were that (a) there were difficulties with the groundnut value chain itself, (b) developing 3 value chains concurrently was a challenge, and with groundnut internal problems, it was delaying the others.

Initially, the problems with groundnuts was with its production and productivity. These were low. Research was not able to document best practices on groundnuts. Varieties were much mixed in the field, and research was not very strong on peanuts.

Relative to other crops, peanut not receiving much attention. The uptake of research on peanuts by farmers is not yet maximized because of the “local market” (not yet export market potentials) for groundnuts. So comparatively, other crops had better prospects than groundnuts as groundnuts had less input response than the other crops. On the external market, local prices of peanuts were higher than external market prices, localizing peanut trade internally.

ACDEP started the first agricultural value chains n the North, and groundnuts was one of the crops. The focus on these crops were that, for ACDEP, the main target of their focus were smallholder farmers in the rural communities; and women production was a key focus area. Focused on sorghum, soyabean and groundnut and picked groundnut because it is a woman's crop and its role in soil fertility replacement and soil management; its nutritional value in the food basket and rural community and also the export potential. Groundnuts also had the potential to increase production and productivity. Peanuts are much consumed locally and is an important part of local diet.

ACDEP is coming back to peanuts because now the whole "infrastructure" is laid down now and discussing with IFDC to collaborate with ACDEP. There is also partnerships being developed with the Netherlands for peanut interventions.

Perspectives on Peanut Production and Procurement

ACDEP had issues with aflatoxin and it still remains an important issues. Groundnut export is complex in terms of aflatoxin. Post-harvest handling affect this; when to shell, drying level, etc. Shelling of groundnuts is a whole problem by itself. There are no appropriate shelling machines, leading to high breakages. To reduce breakage with shelling equipment, you need to water the kernels. This ends up with wet groundnuts and then humidity leading to mold growth. Shipping peanuts also has an aflatoxin chain.

Hermetically sealed bags are mostly used at the point of export at an appropriately dried level. It can also be used at the farmer level if appropriately dried.

Peanut supply should be "even" throughout the year for export, and groundnut must be "one-type" for export. The company must have a certain capacity to store to release.

ACDEP is not engaged with SADA now

SAVBAN Processing and Marketing Company

Interview date and place: July 15, 2013, Tamale
Contact person: Joshua Toatoba, Operations Manager, SAVBAN
Savannah Farmers Marketing Company
0248778374

SAVBAN is a partnership between savannah farmers marketing company and Bandaayili farmers union. SAVBAN was built under the MIDA project as an exit strategy to ensure that the gains of the MCA project is sustained. Thus at the close of the projected it was decided to establish a company to ensure sustainability. There are 20 farmer organization under the union and each FBO has 50 farmer for a total of 1000 farmers. They produce to feed this agribusiness center and SAVBAN processing and markets. They have a 1000mt storage capacity which started in 2012. They employed 4 permanent staff and 7 casual laborers. They deal in 3 main commodities: maize (60%), soybean(30%) , rice (10%).

For the main company their product is soya bean. Supply is based on contract specification based on quality. Aflatoxin is not much of a problem in the north because of the dryness.

The company buys grains after December when the weather is dry. There are no problems with soya bean marketing, Yedent company is buying it for their food supplements for children.

Specifically on groundnut the company decided to move out of peanuts because of the problem with aflatoxin. Handling in the field is a major problem. Farmers usually produce for household consumption.

Currently only a few FBO's that are been supported to produce groundnut through quality and good agricultural practices. It is difficult to know the quality of groundnut one is buying.

Peanut plays a major role in the lives of farmers in the northern region. It is mostly for food and very prominent in peoples diet. There is always peanuts at any point in time in the household for food, and it is an important activity for women for their livelihoods: oil, kulekule, yaji (powdered groundnut), butter for soup.

Aggregators play very important role in the maize, rice, soya value chain that is from production to utilization. Currently there are farmers who do not have money to plough. Aggregators provide them with funds for ploughing, seeds and fertilizers and these farmers pay in kind with produce. During marketing, aggregators facilitate produce that have not been taken up by "elite aggregators" that buys specific grades. Most aggregators go to the production sites to bulk up.

The best way to source produce is through contract farmers . They work with over 20000 individual farmers who sign contracts through their FBO's. SAVBAN signs contracts with the secondary FBO's who signs on behalf of the farmers. The FBO's do the mobilization of the produce and then SAVBAN picks the produce. The FBO's also buys small quantities to store. Hence contract farming is the preferred. It specifies what volumes, prices etc that can be delivered. Based on these projections SAVBAN can determine what supply to expect.

Farmers outside the linkages are not considered but only when it is required to increase supply that spot buying is introduced.

With contracts all negotiations are done in advance: volumes, quality, prices etc. It is better to deal with organized groups. SAVBAN prices are premium prices above the market price because of the quality standard.

On hermetically sealed bags, the company usually would use poly sacks. Thus produce are transported directly to warehouse for storage.

ACTION AID

Interview date and place:	July 15, 2013, Tamale
Contact person:	Esther Boateng, Programme Manager, Northern Region
	0244 781791, estherboateng1965@yahoo.com

Action Aid facilitates agro processors groups mainly women in shea butter and rice
Action work almost entirely (95% with women). Action Aid also have various farmer networks including tamale urban agric network(URBANET).

Action Aid feels that agric financing and adding value is a problem hence started with micro finance with women working with URBANET. Action Aid works with these women to support them with adding value plus marketing.

Action Aid works with them on various agricultural practices that can increase their yield. In the UWR Action Aid is working with women in peanuts.

What URBANET is doing is training the women farmers network. Action Aid does lots of Stakeholder meetings with the women to pin point issues from the women farmers perspective for planning and action purposes. They train the women on post-harvest loses management, Sustainable agriculture practices (composting etc) and financial management tailored to their specific needs.

Contract farming is the best but must be properly done. Start with the FBO's , give them training so they know what goes into the contract(in other words position FBO's to be able to negotiate better). Action Aid built warehouses in communities to facilitate storage and marketing (Inventory Credit Systems). These are managed in the food security manner at the local level. This prevents food shortages during periods of famine

GHANA GRAINS COUNCIL

Interview date and place: July 15, 2013, Tamale
Contact person: Jamail Abduali, Business Development Officer
GGC, Tamale 0249388206

Ghana Grain Council is solely on grains: maize, sorghum, rice. GGC was initially funded by USAID and ADVANCE but currently being funded by FARA. GGC worked hand in hand with ADVANCE (ACDI-VOCA).

GGC work with farmer groups in good agricultural practices and also in agribusiness system intervention especially through post-harvest handling practices.

GGC is into warehouse receipt systems. At the community level, they have 18 community level storage warehouses established in the 3 northern regions each of 80 mt / tons.

At the higher level these small warehouses are linked to larger level warehouses of about 500mt/tons. Who are larger aggregators of grain (GUNDAA produce limited) At this higher level GGC has to certify the warehouse.

Once grain is in these warehouses it is monitored by trained managers. Farmers are trained with moisture meters before the company accepts the liability to store Farmers also have basic warehouse equipment such tapoline.

On aflatoxin training in post-harvest handling is one of the major focus undertaken by GGC. Post-harvest handling of grains in peanuts is major problem that predisposes peanuts to aflatoxin. Depending on the shelf life the moisture content is a major factor.

Contract farmer buying is the best to avoid aflatoxin and low supply. There is a need to train the farmers in the quality in advance , although there has been some problems with some out growers , the nucleus outgrower systems is still the best and it is better to deal with the groups than with the farmers scattered all over

ACDI/VOCA (ADVANCE)

Interview date and place:	July 15, 2013, Tamale
Contact person:	Mr Collins Kyei Boafo, Regional Coordinator/ Technical Leader (Outreach) 0577600370

Aflatoxin is not a big problem in the Northern Region as the weather is favorable. There has been lots of training of our farmers from production to post harvest loss and linking them to buyers. Most producers produce good grains and no how to store hence aflatoxin is much of a problem for their marketing. Quality is high and they are able to meet their production cost. Currently there is maize glut and maize is selling at GH38/100kg. this is bad for the farmers but good for overall marketing so there is a need to have more marketing interventions. There are no problems with rice and soya. For rice all quantities are sold and for soya quality has improved and companies are buying the products at good prices.

On the role of aggregators, the role they play in the supply chain is so vital they make normal prod=fit. Framers have been trained to understand aggregators so they can work together. Aggregators especially nucleus farms invest in farmers : they plough for them, add seeds and fertilizers and farmers pay later in kind. The aggregators invest in framers on interest free so they sort of subsidies farmers production. This is because the aggregator usually borrows money and has to absorb the interest. They take risk on behalf of the farmers.

On the issue of large farms own by outsiders we are not seeing the south African model where there is a large producer surrounded by relatively small holders. Actually the land tenure system in the north is not pulling investors into large farms. Women are found farming on marginal lands but surprisingly, in terms of gross margins they are performing better as they have learnt through training. However we need large scale farming, the small holder 1-2 acres are not increasing production as required. There are still more lands available to increase production and labour as well.

Contract farming is preferred and farmers should know the end markets . it is also important to bring buyers and producers together to discuss all modalities in a holistic manner with the aim of the farmer learning contract engagements with large aggregators and to agree on prices and production modalities and to share in risks.

On hermetically sealed bags, these are available and can stored food produce for about six months. Action aid gave these free to farmers and when free distribution ended , farmers had to buy at 4 cedis a bag and these are sold on market days in the community.

MINISTRY OF FOOD AND AGRICULTURE (Tamale Office)

Interview date and place:	July 16, 2013, Tamale
Contact person:	Mr. William Boakye-Acheampong, Regional Director 0244 216 918 Mr. K.D. Antwi, M&E Officer 024 3612023 Mr. Festus Aron Langkuum, Asst. M&E Officer 0268666631

Aflatoxin is not much of a problem in the north. The challenge is in the south. In the north a little "SANITY" and you would get the best of products. There is a need to put in quality standards and measures. Aflatoxin is more in the transitional zone because of the rainfall. Farmers harvest while it is still raining or wet

It is important to get products through aggregators for the volumes. Aggregators needs to encourage farmers to produce more.

Peanut is a cash crop now. However nobody is championing peanut in the northern region and there is not much of attention now on peanuts and cowpea. Focus now is on maize rice and soya. Based on the value chain concept, now a product must have a buyer before it is cultivated (a ready market is needed for production to be worthwhile). Thus area under peanut cultivation can increase when the market is properly identified. Currently soya is replacing peanut.

On hermetically sealed bags, the products must be well dried and airtight then it can stay for long. Mainly used for cowpea: PICSs (Purdue Improved Cowpea Storage systems)

MINISTRY OF FOOD AND AGRICULTURE (Dept of Agricultural Engineering, Accra)

Interview date and place:
July 10, 2013, Accra
Contact person:
Mr Johnson Yao Panni, Senior Agricultural Officer/Post Harvest Officer;
Ministry of Agriculture, Agric Engineering, Ministries-Accra
jypanni@yahoo.co.uk, 0208172110

Avoiding aflatoxin in products depends on (a) harvesting on time; (b) thorough drying to the required moisture content, (c) storage environment—storing in a bulky environment without spreading them in a room after daily drying in the sun creates the aflatoxin conditions, (d) packaging material. Grains breathe, and if not in equilibrium then differences in temperature can enhance their growth.

Harvesting losses are high during the dry seasons. Manpower in harvesting is a major problem. Farmers usually will harvest when wet and also not to lose the vines for animal feed.

There is the need to have continuous training of aggregators not to mix commodities of different dryness. Mechanical damage is serious, especially on broken nuts.

Aflatoxin not serious in northern Ghana compared to the transition zone. The type of variety also counts.

Aflatoxin is very high among traders because they keep produce to speculate (once they store, they do not bring them out to dry again). At farmers' level, they store in pods. Training and provision of price incentives can solve the aflatoxin problem.

Storing pods in hermetically sealed bags will only work if the pods are dry to the required moisture content.

The shelling of peanuts will require groundnut decorticator. Presently what farmers do is to hit with a stick with the peanut in the sack and then complete by hand cracking one by one. Hitting nuts leads to cracking and predisposes nuts to aflatoxin.

Agricultural engineering is promoting solar dryers for fruits and vegetables and GIZ is introducing simple solar dryers for maize and cassava chips. These solar dryers in an 8 hour period can reduce moisture content from 18% to 13%.

There are kits for testing of aflatoxin but these are not readily available and the ministry is advocating this simple test kits for aflatoxin. At Agric Engineering they are using pro-cocoon for the national strategic buffer stock in maize

SARI

Interview date and place:

July 16, 2013, Savannah Agriculture Research Institute, Tamale

Contact persons:

Edward Martey — Research Scientist (Economics) (0242344450)
Prince M. Etwire — Principal Technical Officer (0243241464)
Richard Oteng-Frimpon — Research Scientist (0208080916)

Farmers per say are not aware of aflatoxin. They do not mention aflatoxin as a problem. Due to the bulky nature of seeds for planting, most NGOs hardly go into seed production. Farmers have to plant their own seeds. One requires about 80kg /ha for a farm.

Community prestige attached to peanuts is low. The man prefers to plant his yam, maize so the woman must plant quickly on the piece of land for the main to cultivate his maize.

In 2005 four varieties of peanuts were released. Currently two new varieties released. The latest is known as "NKATIE SARI" with a yield of 2.2mt/ha. It has a dual purpose; seed and fodder. Over 70% of farmers grown the Chinese variety because of the cream colour and its early maturity of 90 days.

There is no fertilization in peanut cultivation, although it is recommended that 25-30kg/ha of TSP should be added just after germination. Yields indeed improve under irrigation system. The best irrigation type is the drip system; however furrow irrigation can be applied

In terms of supply bulking and quantity, it is contract farming that provides cost effectiveness. The nucleus-outgrower farmer system provides high quality outputs. But transaction costs are high. There is a need to provide support in terms of inputs to enhance the arrangement
On the hermetically sealed bags, 2-3years ago PICS were introduced and worked well for cowpea. An agro dealer was selling the product and it was effective against insect pest. Whether it can work for peanuts, depends on how well it is dried. Peanuts can better be stored in shells than peeled. Ultraviolet lights can be used to separate unshelled seeds

SNV - Netherlands Development Organisation

Interview date and place:	July 16, 2013, Tamale
Contact person:	Isaahaku Zakaria (Media Advisor, Agriculture) SNV (020 9105146, izakaria@snvworld.org)

SNV are in three major areas: agriculture, renewable resources and WASH. In agriculture, the focus is on sesame, shea nuts and butter, crops/livestock and NTFPs (baobab, moringa, honey, etc.)

For peanuts, the major issue is the timely harvest of the crop. Post-harvest activities predispose peanuts to aflatoxin. To reduce aflatoxin, interventions in the peanut value chain must be at the post-harvest level: well dried, stored etc. Peanut is a major cash crop and a woman's crop but too much price fluctuations.

Land grabbing is reported in the north by Chinese but not much work is been done on these lands. Small scale farming is more sustainable and productive than large scale farms in our systems. Large scale farms are not environmentally friendly. Small holder farmers manage lands more sustainably. With support of inputs, the small holder farmer can handle productivity increasing activity. Most of these large farmers are going into mango and cashew production which is promoted by EDAIF

Have several models: Soya bean model where they work through cooperative based approach. Farmers form groups and contracts are signed with upper level leadership and negotiate on supply terms. This approach needs a lot of facilitation. The disadvantage here is that there are several free rider aggregators who do not help in building these cooperatives but come in to offer higher prices that shift the farmers away from the arrangements to these free riders. The advantage is that if it is a more open and transparent process then there is mutual trust which guarantees a more sustainable income and supply of products.

There also exists the nucleus farm model championed by ADVANCE. This is more capitalist and less of social development since investment is more on an individual farmer. When this individual becomes powerful, price negotiations becomes dictatorial. However nucleus or out grower system reduces cost of operations in aggregating supply and the nucleus and out grower must agree on price up front.

Hermetically sealed bags are mostly used in beans but not on peanuts. SNV tried it in 2011 as they received training from USDA. Usage has been limited to beans but it has been successful. World Vision International promoted it buy not on a large scale and only for beans

CARE International

Interview date and place:	July 15, 2013, Tamale
Contact person	Isahaku M. Hardi Project Officer, Pathways to Secure Livelihoods, Women and Agriculture Programmes, CARE International

CARE has a women in agriculture programme that focuses on two commodities, soyabean and groundnut, in 21 communities in two districts: Garu-Tempane, UER, and Lambusikani, UW.

Four workers at CARE work on this program with partners in each of the district. CARE chose these crops to promote women livelihoods. Peanuts and soyabean are very important womens' crops in the north.

Aflatoxin is not much of a problem in the north. But poor post-harvest handling can predispose nuts to aflatoxin. Besides maize, peanut is one the most important cash crop/food crop in the household.

Aggregators are the direct contact with the farmers. They move produce from farm gate to marketing centers. They provide dual roles: apart from buying the products, aggregators' pre- financing is a big part of the role they play. They provide input/ cash credit to farmers to start the farming season.

Contract farming is cheaper and easy to bulk. Farmers need to be provided with training, inputs and technical assistance to ensure quality and higher yields.
On hermetically sealed bags, in 2010-2011, these where given to farmers in maize, groundnut and beans production and the response was good. MoFA were selling this but are not common on the markets.

CARE's role in the project is to link the women farmers to markets. Currently there are ready markets for peanuts (Ghana Nuts Oil, Techiman, Golden Web, Kumasi, Vester Oil, and Kumasi have expressed interest).

Savannah Farmers Marketing Company

Interview date and place: July 17, 2013, Tamale
Contact person: Janet Adama (Managing Director), 0244 316758
Savannah Farmers Marketing Company, Tamale

The firm worked with peanuts up to 2005-2006, but had to drop peanuts from the chain because of inadequate volumes to supply international buyers. There was also little understanding of how contracts work. SFMC had a contract with a Dutch company, the contract was good and signed by a Dutch manager who thought that the farmers had signed also, and the company was shocked when the farmers did not supply as needed. That year was bad weather and production was slow. The company was to supply volumes in October, November and December, but could only supply in October and with low volumes, farmers did not bother. This was because the domestic price was better than what was being offered for the external market, again, the company wanted shelled groundnut in October but the farmers were not ready to shell at that time. So farmers were keeping their nuts. In October farmers are busy with other crops and only shell off season (lean season). It is also easy to keep groundnuts in shell because of poor storage, and farmers were selling their maize first.

The bottom line is that for peanuts the volumes are not there. Production technology is too labor intensive and only a little aspect of the chain is mechanized. The SFMC bought locally fabricated shellers from ITTU to shell but either the machine splits the nuts when tightened or it allows unshelled nuts through if you loosen it, thus abandoned. The equipment is not adequate to mechanize peanuts value chain.

Peanut is important for food and cash crop but not for large scale production. Research needs to promote high yields and stakeholders need to work with scientists on varieties that are high yielding. There is the need to partner local entities to have large tracts of land for cultivation.

In NR land is not a problem but the procedure to acquire is. So getting land involves community inclusion along the nucleus outgrower scheme that engages the community through a local partner.

It wasn't much of a problem then in their dealings with the export. But do know that the poor handling of the products predisposes to aflatoxin. Generally the farmer do not know what aflatoxin per say is. MoFA must be educating the farmers on this.

In contract farming to engage FBO's , the issue is what are you bringing on board: inputs, machines for ploughing and shellers. So contracts based on inputs for payments in kind using outputs would be a disaster.

The trick is to pass through a local agent (nucleus farmer system). For spot buying, buy spot only when your price is super good above market price. You must be prepared to first gain the confidence of the farmers in the first instant.

To buy spot you must also have your workings right, so eg a good relationship plus good price then you can pick spot. “No trust, no goods”.

For hermetically sealed bags, SFMC hasn’t used it directly. To use it for groundnuts depends on how well it is dry and there is always a difficulty in drying peanuts. On UV light technology to sort, would depend on the engagement rule with the farmers. Whether the company is buying nuts shelled or unshelled and it should be part of the whole scheme to sustain this.

Advice is not to directly engage farmer groups for production (supplies), but go through local enterprises. There is however the need to identify credible aggregators who have the capacity to deliver. SFMC can come back to peanuts if only a good contract that takes the local terrain into consideration is put in place

CARD - Centre for Agriculture and Rural Development

Interview date and place: July 16, 2013, Tamale
Contact person: Naresh Shukla (Manager)
Centre for Agriculture and Rural Development
02444716849, Tamale

CARD started in 1998, and has 3 companies: CARD itself employs 44 employees and deals in for main commodities: maize, soybean, groundnut and rice; DURGA company and aggregator, warehousing and marketing started in 2000; and CARDFNGO granted license to operate by the Bank of Ghana, 2011.

Currently they have about 8700 farmers and operate in 9 districts. CARD has individual data base on each farmer and has opened credit account for all the farmers under the FNGO. It has investments of about 3 million USD and a turnover of about 10 million USD each year. Every two years field officers get new motor bikes to enhance efficiency.

Small holder farmers need interventions in training and advocacy. Aggregators talk of premium price for sorting but is not much of a problem in the north. Produce must be well dried and well stored and this must be the work of the aggregator to minimize aflatoxin. Technical officers must work with the farmers to reduce this aflatoxin

Aggregators connect farmers with industries. They are traders and trade on demand bases. Large farms can displace smallholders but skeptical about the out grower nucleus concept due to price dictate by nucleus.

CARD mobilizes the farmers through training and sensitization for production. DURGA meets farmers' needs in inputs with services in order to implement the technology and views of the importer. On hermetically sealed bags, this is good at the aggregator level. Farmers disperse small quantities of produce to meet daily needs. Farmers need technical advice in these areas. Experience at the local level is very important.

BASA Agrobusiness

Interview date and place:	July 17, 2013, Aboabo Market, Tamale
Contact person:	Alhaji Bawa, 0244 454247
	BASA Agrobusiness (trader/aggregator)

This firm is an aggregator of grains and nuts, which supplies to companies such as Ghana Nuts. Due to the problem of aflatoxin, purchasing of peanuts stopped, but it is currently aggregating soyabeans, rice and cowpeas. It now supplies peanuts on commission basis, working with 62 agents who have their farmers in the various districts that they buy from. Agents are in Gusheigu, Savelugu-Nanton, and Karaga who go to buy and bring it Basa Agro-Business in Tamale market.

The firm buys shelled groundnuts of 85kg, or unshelled groundnuts of 10 bowls equivalent to 20kg, but prefer shelled groundnuts due to the risk of being supplied with bad nuts when purchased unshelled.

The firm personally pre-finances each agent to do their transactions. The firm is able to supply high volumes of whichever quantity, hence no problem of sustainability.

The firm encountered the problem of aflatoxin during its dealings with the Ghana Nuts Company. This was as a result of groundnuts not drying adequately before being supplied, when the buyers came earlier than contracted dates. But no experience currently due to training offered on post-harvest management of peanuts. Hence to deal with aflatoxin peanuts are allowed to dry very well before storage.

The nucleus buying is the best since farmers have their individual customers they sell to. Farmers prefer to keep their produce and sell later to take advantage of high prices. Currently in 2013, there is less demand for groundnut and a huge supply, thus hence in stock groundnut is selling for 240/85kg but with new harvest this price is likely to fall.

Africa Atlantic Holdings Ltd
Interview Date: August 13, 2013

Contact Person: Nathan Heston, Ph.D.
Africa Atlantic Holdings, LTD
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The firm has a land holding of about 26,000 acres (10,600ha) in the Afram Plains. The firm is gradually developing the land. Currently it has developed about 100 acres of the land and is test cropping: 8-10 varieties of wheat; sunflower, maize and peanuts.

Currently (August 2013), the firm is harvesting and sun-drying corn. They plant a 2-3 cycle of maize per year under irrigation. Yields of maize from 2010 under irrigation have been about 4.5 mt/acre (about 11 mt/ha). In 2009/10 when the firm started, and without irrigation, it made 1.5 mt/acre.

The company has had discussions with Hershey on incorporating peanut cultivation into their operations. This they have adopted and will be part of their planning. They started planting/inter-planting with peanuts this cropping season (April 2013).

The Firm has plans to establish an Agribusiness Knowledge Centre (a School) in collaboration with Harvard and MIT. Stanford University will collaborate on the business side through Stanford's $150 million Endowment Fund for International Business Development. The firm intends to develop curricula and has plans for buildings. The idea is to help smallholder farmers to gain practical and business skills to integrate into commercial (viable business) farming. It will combine both academic and commercial activities.

The land acquired is registered. It was acquired through negotiation with the paramount chief/elders of the area. The firm has plans to involve/include the local/smallholder farmers in decisions to be made. It has plans to lease lands through the nucleus-outgrower system

Burger Food Industries

Interview Date: August 14, 2013
Contact Person: Mr. Quansah Justin (0242814791)

Burger Food Industries is engaged in the production of Peanuts Snacks for 13 years since 2000. It is a Purely Private Individual business owned model with 302 employees. The company produces between 1900-2000 cartons (Net weight of a carton is 50g*144 pouches) per day. The company exports over 85% of her production to Nigeria.

The company currently sources its peanuts for production from imports from Burkina Faso. Last year, the company went as far as Mali and Guinea to source groundnuts for her production. The company buys in the lean season, a bag by weight of 85kg and in the peak season (September, when fresh but dry) of weight 90kg/bag.

Until 2006, the company sourced her peanuts from Wa in the Upper West Region of Ghana and northern Volta in Ghana. However supply capacities in these areas have decreased mainly from the flooding that occurs with the dam opening in Burkina Faso. Currently, the company usually gets peanut supply from Ghana from between November-December, and then supply falls drastically that the company has to import. In order to source more of peanuts from Ghana, the company calls for government intervention to help increase supply of nuts for production.

The company faces no constraints with domestic regulatory institutions and she works well with the Ghana Standard Authority, Food and Drugs Board, Factory Inspectors, Internal Revenue Authority and the Valued Added Tax Authority. The company however complains bitterly of the impediments placed on shipping overland her products to Nigeria, ECOWAS protocols notwithstanding.

Aggregation of peanuts for production

The company had 2 Agents but is currently working with just one Agent for the supply of peanuts to the company. The company pre-finances the purchase of peanuts. The agent has aggregators in all the peanut producing regions. The Agents deliver supply on demand from the company. The company has a storage capacity of 2000 bags but there is the construction of a new processing facility that has a storage facility that can hold over 10000 bags of peanuts to increase production capacity.

Controlling for Aflatoxin infested Nuts

The company has a sorting and sifting/sieving departments that employs mechanical sieving and factory hands, mostly women (between 240-250 women running 3 shifts in the day between periods of 8hours) to sift and sort purchased peanuts as a way of minimizing the processing of aflatoxin infested kernels.

Two types of waste arise from sorting/sifting. These are (a) Small waste (should not exceed 10% of purchased products and involves sorting for stones and breakages) and

(b) big waste (should not exceed 5% of purchased products and involves peeled, cracked/split and colored nuts). Where these wastes exceed the company allowed thresholds, the agent reimburses the company for the excess.

After sieving and sorting, the “best” grains are again sorted by hand at the sorting department before it goes through the process of steaming, coating with flour, frying, cooling and bagging.

3. Other potential partners

From our desk review, we identified a limited number of potential partners in addition to the key informants interviewed in the site visits. Those listed here have broad interests across the entire peanut value chain. Any specific investment or initiative would also consider other partners, including those with narrower interests in a specific aspect of the peanuts sector.

1. Ghana Ministry of Food and Agriculture (MOFA)

Ghana Commercial Agriculture Project (GCAP)

"The Government of Ghana (GoG) has engaged the World Bank and USAID in supporting agricultural development project – the Ghana Commercial Agriculture Project (GCAP), with the principal objective of improving the investment climate for agri-business and developing inclusive Private-Public Partnerships (PPPs) and smallholder linkages aimed at increasing on-farm productivity and value addition in selected value chains."

2. Savannah Accelerated Development Authority (SADA)

Director – Dr. Emmanuel Abreere-Inga

The Savannah Accelerated Development Authority (SADA) is an independent agency mandated by Act 805 of 2010 to coordinate a comprehensive development agenda for the northern savannah ecological zone in Ghana. The area comprises the three northern regions of Ghana namely, Upper East, Upper West and the Northern Region, and stretches to include districts contiguous to the Northern region that are located north of Brong-Ahafo and north of the Volta region. SADA constitutes Ghana's response to effects of climate change associated with floods and draught. The agency's main thrust is to promote sustainable development using the notion of a forested and green north to catalyze climate change reversal and improve livelihoods of the most vulnerable citizens in the area. The strategy being developed will provide opportunities for poor peasants, especially women, to own assets in economic trees, sustain their food crop production and protect the fragile ecosystem of the northern savannah by managing the flood-prone river-beds better

3. Finatrade Foundation

The Chairperson of Finatrade Foundation - Ms. Joyce Aryee

The Foundation's objective is to re-invigorate the Ghanaian agricultural sector, for which reason Finatrade in 2004 instituted the Foundation which now ran about four projects in the country, namely the Finatrade scholarship scheme for students and the Kwame Nkrumah University of Science and Technology model farm.

The others are the Information Communication Technology and the Finatrade Humanitarian Projects which have saved the lives of many Ghanaians with heart, kidney and other health-related problems, where beneficiaries could not afford to pay for the treatment offered them.

4. The Netherlands Development Organization (SNV)

SNV has been present in Ghana since 1992. SNV Ghana contributes to poverty reduction as articulated in the Ghana Growth and Poverty Reduction Strategy, the national development blueprint, which is in line with the Millennium Development Goals (MDGs).

SNV Ghana works in collaboration with other partners to reduce poverty through capacity building with local actors. Our wide range of services includes advisory services, knowledge networking, evidence-based advocacy and value chain development. We believe in inclusive growth and development as an essential feature for lasting development success.

As part of its strategy from 2012 onwards, SNV Ghana will focus its activities in three main sectors; Renewable Energy, Water, Sanitation & Hygiene (WASH) and Agriculture (Fruits, Vegetables and Oil Seeds). Cross-cutting programs include Gender, Governance for Empowerment and Enabling environment. With the SNV Ghana head office located in Accra, its activities are coordinated by Country Director, Amagoin KEITA.

Contact details

SNV Ghana, No. 10 Maseru Street, East Legon Residential Area
P. O. Box KIA 30284
Tel: +233 (0) 30 7012440 / 7012441 or Email: ghana@snvworld.org

5. Savanna Agricultural Research Institute (SARI)

Savanna Agricultural Research Institute (SARI) is one of the thirteen (13) research institute of the Council for scientific and Industrial Research Institute (CSIR). It was originally known as the Nyankpala agricultural Experimental Station (NAES) and operated as an outpost of Crop Research Institute (CRI), Kumasi. In 1994, it gained autonomy and was upgraded to a fully-fledged research institute and thus renamed Savanna Agricultural Research Institute-SARI for short. SARI is located 16 kilometers west of Tamale in the Tolon/Kumbubgu District of the northern region of Ghana. SARI's mandate is to provide farmers in the Northern, Upper East and Upper West Regions with appropriate technologies to increase their food and fiber crop production based on a sustainable production system which maintains and/or increases soil fertility.

6. Crops Research Institute

The Crops Research Institute (CRI) is part of Ghana's Council for Scientific and Industrial Research (CSIR). It seeks to:

- Develop improved crop varieties that are high yielding and resistant/tolerant to important biotic and abiotic stresses and have good quality characteristics.
- Develop improved production technologies for sustainable production
- Assist in the achievement of food security and self-sufficiency in industrial raw material production
- Play a leading role in the diversification of agricultural production in Ghana

4. Ghana Standards Authority Procedure for Certification

GSA PROCEDURE FOR CERTIFICATION OF LOCALLY MANUFACTURED GOODS

STEP 1
Submission of formal application on CM Form 1-Application for licence to use the Ghana Standards Authority certification Mark.

STEP 2
Vetting of completed CM Form 1 for completeness.
Criteria for completeness-
- All relevant information has been provided by applicant
- All relevant documents have been attached (Scheme of inspection and test; copy of company registration certificate; copy of the product label where appropriate)

STEP 3
Review of applicant's request.
The purpose of this activity is to ensure that –
- The applicant's request is well understood
- The resources and capability for executing the contract are available
- The applicant understands the rules of the certification mark system including the conditions for granting, maintaining, extending, suspending and withdrawing of certification

STEP 4
Registration of applicant (company) Entering particulars of applicant in register
Further processing of application is subject to payment of appropriate testing and processing fees. (Fees for services rendered in connection with certification are based on the most current fee structure and vary according to type of product. Currently the fees range from (GH¢100.00 – GH ¢500.00 per product.)

STEP 5
Factory inspection
This activity involves –
- Inspection of records to determine compliance with agreed requirements.
- Inspection of manufacturing process to determine whether the plans and procedures established for the assurance of quality are followed.
- Sampling. (Take representative sample of the batch; the sample size should at least be enough for type testing and to cater for contingencies such as repetition of test for confirmation of results)

STEP 6
Conformity evaluation of product. This activity may include –
- Testing of product (Indirect method) ; and or
- Performance test (Direct method)

STEP 7

Convening of Certification Mark Committee Meeting

Licence is granted when the following conditions are satisfied.

- The factory inspection report is favourable;
- The product quality is acceptable
- The labeling / marking of product is satisfactory

Decisions of the CMC are communicated to the applicants. Where the application fails the client is informed of the aspects of quality where his or her product failed to meet the specified requirements.

STEP 8

Issue of licence

The licence is designed to indicate-

- The standard specification applied in the evaluation
- The unique registration number of the applicant / company

STEP 9

SURVEILLANCE (FACTORY QUALITY AUDIT & MARKET SURVEILLANCE)

GSB conducts surveillance to determine continuous compliance with the specified requirements of the certification system. The licence may be suspended /cancelled whenever the quality of product cannot be assured

5. Ghana FDA Guidelines for the Registration of Prepackaged Foods

FOOD AND DRUGS AUTHORITY

GUIDELINES FOR THE REGISTRATION OF PREPACKAGED FOODS

Document No.: FDA/FERD/GL-REG/2013/01
Date of First Adoption: 1st February 2013
Date of Issue: 1st March 2013
Version No.: 01

TABLE OF CONTENT

1. INTRODUCTION

In exercise of the powers conferred on the FDA by Public Health Act, 2012, Act 851, Part Seven, Section 148, these guidelines apply to the registration of prepackaged food in order to ensure the safety and quality of prepackaged food. These guidelines apply to all prepackaged food products that are:

a) Locally manufactured/produced

b) Imported

and are intended for human and animal consumption, distribution or to be offered for sale in Ghana.

The purpose of these guidelines is to provide guidance to prepackaged food manufacturers, producers and food importers on the requirements of the Food and Drugs Authority and the procedures by which prepackaged food shall be brought into compliance with Part Seven, Section 97 of the Public Health Act, 2012, Act 851.

These guidelines are hereby promulgated for information, guidance and strict compliance by all concerned.

2. GLOSSARY

For the purpose of these guidelines the following definitions shall apply:

"***Prepackaged food***" means a food substance packaged or made up in advance in a container, ready for offer to the consumer, or for catering purposes;

"***Label***" means any tag, brand, mark, pictorial or other descriptive matter, written, printed, stenciled, marked, embossed or impressed on, or attached to, a container of food.

"***Non-compliant product***" means any product that does not conform to relevant current specifications for the product in question.

"*Requirements*" are the criteria set down relating to trade in foodstuffs covering the protection of public health, the protection of consumers and conditions of fair trading;

"*Renewal*" means to make valid for a further period or extent, the validity of the registration of the prepackaged food for the period determined by the Board.

"***Deferred application***" means the application for registration of the product was deferred because the prepackaged food product does not comply with sections of the law or the General Labeling Rules. The registration is therefore put on hold until the product is reasonably brought into compliance with the law;

"***Rejected application***" means the application for registration was rejected because the prepackaged food was deemed unfit to be distributed, sold or used in the country for reasons which may include the product being found fake, adulterated or contaminated. The applicant may reapply for registration after corrective measures have been taken.

"Product variation" means formulation of the product has been altered (ie addition of ingredient, subtraction of ingredient or a major change in the formulation of the product).

3. REQUIREMENTS

3.3.1. REGISTRATION OF LOCALLY MANUFACTURED PREPACKAGED FOOD

An applicant shall, for the registration of locally manufactured prepackaged food:

3.1.1. Purchase and complete the under listed forms;

1. Application for licensing of Food Manufacturing Establishment (FDA/FM05/LOC/01);
2. Food Product Information (FDA/FM05/LOC/02); and
3. Premises Location Form (FDA/FM05/LOC/03).

3.1.2. Submit the above forms in addition to the following;

1. Business Registration Certificate;
2. Certificate of Analysis;(See Appendix 1)
3. Site Master File; (See Appendix 2)
4. Health/Food Handler's Test Certificate for Tuberculosis, Hepatitis A, typhoid and other communicable diseases for each worker on production line;
5. Documentation substantiating any claim on health, nutrition, superlative, comparative, etc. on the label;
6. Six (6) samples of each product as stated in sample schedule (see appendix 3);
7. A copy of the product label;
8. Total Registration fee as stated in the Food and Drugs Authority's Fee Schedule (non-refundable)

3.1.3. The application shall be addressed to

THE CHIEF EXECUTIVE
FOOD AND DRUGS AUTHORITY
P. O. BOX CT 2783
CANTONMENTS, ACCRA

3.2 REGISTRATION OF IMPORTED PREPACKAGED FOOD

An applicant shall, for the registration of imported prepackaged food:

3.2.1. Purchase and complete the under listed forms;

1. Imported Food Product Information Form (FDA/FM05/IM/02);
2. Warehouse Location Form (FDA/FM05/IM/03); and
3. Application for Registration as a Food Product Importer Form (FDA/FM05/IM/01) where necessary.
4. Application for Dry Food Storage Facility License (FDA/FID/FM-DFW/2013/07)
5. Application for Cold Food Storage Facility License (FDA/FID/FM-CFW/2013/07)

3.2.2. Submit the above forms in addition to the following:

1. Business Registration Certificate;
2. Sanitary or Phytosanitary Certificate where applicable;
3. Certificate of Analysis;
4. Radiation certificate for the food product where applicable;
5. Documentation substantiating any claim on health, nutrition, superlative, comparative, etc. on the label; where applicable
6. Six (6) samples of each product as stated in sample schedule (see appendix .3):
7. A copy of the product label; and
8. Total Registration fee as stated in the Food and Drugs Authority's Fee Schedule. (non-refundable)

3.2.3. The application shall be addressed to

THE CHIEF EXECUTIVE
FOOD AND DRUGS AUTHORITY
P. O. BOX CT 2783
CANTONMENTS, ACCRA

3.3 RENEWAL OF REGISTRATION

The Registration of a pre-packaged food is valid for three (3) years and must be renewed by the end of the third year. The registration shall be approved by the authority before any importation of the product, other than those used as samples for the purpose of this application, into the country.

3.3.1. REGISTRATION RENEWAL OF LOCALLY MANUFACTURED PREPACKAGED FOOD

An applicant shall, for the renewal of registration of a locally manufactured prepackaged food;

3.3.1.1. Complete a copy of Locally Manufactured Food Product Information form (FDA/FM05/LOC/02)

3.3.1.2. Submit the above form in addition to the following:

1. Certificate of Analysis; (only for product variations)
2. Copy of current Business Registration Certificate.
3. Copy of previous FDA Registration Certificate or Letter.
4. Two (2) samples of each product as stated in sample schedule (see appendix .3);
5. Registration renewal fee as stated in the Food and Drugs Authority's Fee Schedule (non-refundable)
6. Supporting documentation for any variations since the product was last registered.

3.3.1.3. The application shall be addressed to;
THE CHIEF EXECUTIVE
FOOD AND DRUGS AUTHORITY
P. O. BOX CT 2783
CANTONMENTS, ACCRA

3.3.2. RENEWAL OF REGISTRATION FOR IMPORTED PREPACKAGED FOOD

An applicant shall, for the renewal of registration of imported prepackaged food:

3.3.2.1. Complete the Imported Food Product Information form (FDA/FM05/IM/02).

3.3.2.2. Submit the above form in addition to the following:

1. Certificate of Analysis (only for product variations)
2. Copy of current Business Registration Certificate.
3. Copy of previous FDA Registration Certificate or Letter.
4. Two (2) samples of each product as stated in sample schedule (see appendix .3);
5. Total Registration Renewal fee as stated in the Food and Drugs Authority's Fee Schedule (non-refundable)
6. Supporting documentation for any variations since the product was last registered.

3.3.2.3. The application shall be addressed to;

THE CHIEF EXECUTIVE
FOOD AND DRUGS AUTHORITY
P. O. BOX CT 2783
CANTONMENTS, ACCRA

3.3.2.4. Only company owners and/or competent company representatives with adequate knowledge of the company must complete the application form. Clearing agents are not allowed to complete and/or the application form.

3.3.2.5. Bulk/Group registration of products can only be considered if the categories and/or different food groups, which will be determined by the Authority, are more than fifty (50).

4. TIMELINES

4.1. Where all registration requirements have been met, the registration process shall take a maximum of thirty (30) working days from the date of submission of application.

4.2. Where the Food Drugs Authority is satisfied that there is the need to register a food product, it shall do so and issue to the applicant a certificate of registration, subject to such conditions as may be prescribed by the Authority from time to time.

4.3. The Food and Drugs Authority may defer or reject an application.

4.4. Applicants shall respond or address any issues raised concerning their applications within a period of sixty (60) working days of issue of the notice.

4.5. Applications submitted but awaiting samples from the manufacturers/applicant to continue the registration process shall not exceed sixty (60) working days from the date of submission of the application.

4.6. If the Authority does not receive any response or samples within the period specified under 4.4 and 4.5, the applicant shall reapply for registration.

4.7. An appeal for the review of an application may be made in writing to the Authority within thirty (30) working days of issue of the rejection notice.

5. SANCTIONS

5.1. The Authority shall cancel, suspend, or withdraw the registration of a food product if:-

1. the grounds on which it was registered is later found to be false;
2. the circumstances under which it was registered no longer exist;
3. any of the provisions under which it was registered has been contravened; or
4. the premises in which the food product or part of the food product or premises, where it is manufactured, packaged or stored by or on behalf of the holder of the certificate of registration is unsuitable for the manufacture, packaging or storage of the food.

5.2. Where the registration of a food product is rejected or cancelled, the applicant shall ensure that the product does not find its way into trade.

6. PENALTIES

Where non-adherence to this guideline results in exposure of consumers to a food safety risk, the FDA will impose an Administrative charge in accordance with Section 148, Sub-section 4 & 5 of the Public Health Act, 2012, Act 851 .

APPENDIX 3: SAMPLE SCHEDULE

LIQUIDS SIZE OF PACKAGING	QUANTITY OF SAMPLE(S)
1L – 2L	6
>2L – 10L	3
>10L	1

SOLIDS SIZE OF PACKAGING	QUANTITY OF SAMPLE(S)
600g – 2Kg	6
>2Kg – 10Kg	3
>10Kg	1

WINES AND HARD LIQUORS

LIQUIDS SIZE OF PACKAGING	QUANTITY OF SAMPLE(S)
2 L	4
>2L – 10L	2
>10L	1