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Strengthening Partnerships, Results, and Innovations in Nutrition Globally

Assessment of Market Premiums for Aflatoxin-Safe Groundnuts in Northern Ghana

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ABOUT SPRING

The Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project is a six-year USAID-funded cooperative agreement to strengthen global and country efforts to scale up high-impact nutrition practices and policies and improve maternal and child nutrition outcomes. The project is managed by JSI Research & Training Institute, Inc., with partners Helen Keller International, The Manoff Group, Save the Children, and the International Food Policy Research Institute.

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Acronyms and Abbreviations

AGRA	Alliance for Green Africa
AVCMP	Agricultural Value Chain Management Project
EED	environmental enteric dysfunction
EMA	end market aggregator
EMDM	end market decision maker
EU	European Union
HPM	Hedonic Partial Model
IFDC	International Fertility Development Corporation
MOFA	Ministry of Food and Agriculture
NEMA	near-end market aggregator
PMIL	Peanut and Mycotoxin Innovation Lab
PSE	price sensitivity effects
PTAP	preparedness to accept or pay
PUF	price utility function
PWTA	preparedness and willingness to accept
PWTAP	preparedness and willingness to accept or pay
PWTP	preparedness and willingness to pay
RCBD	randomized complete block design
SADA	Savannah Accelerated Development Authority
SAS	Statistical Analysis Software
SMA	source market aggregator
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization
WTA	willingness-to-accept
WTAP	willingness to accept and pay
WTP	willingness-to-pay

Executive Summary

In 2016, SPRING commissioned a study to investigate whether market aggregators would be willing to pay a premium for aflatoxin-safe groundnuts. Such a premium would reflect market demand for higher quality groundnuts and incentivize the production of safe groundnuts. SPRING was interested in understanding strategies that could provide economic incentives for farmers to adopt good agricultural practices, and thereby reduce the risk of aflatoxin contamination.

Groundnuts are an important source of protein and income in many farming communities in Ghana. Yet production is largely unregulated, leading to unsafe levels of aflatoxin, with negative effects on public health and the economy.

Domestic demand is high; Ghanaians consume the majority of groundnuts produced in the country. Limited quality control mechanisms, however, mean that groundnuts often fail to meet international safety standards, such as those for aflatoxin contamination.

Interviews with aggregators and end market buyers revealed low awareness of aflatoxins. Although end market buyers had heard of aflatoxins on the radio, they had limited understanding of the dangers they pose to human health and nutrition.

Aggregators preferred groundnuts that were produced, harvested, and hand-shelled in the Upper East Region, where dry conditions produce fewer moldy and rotten groundnuts. Buyers also preferred good quality groundnuts that suppliers had pre-cleaned and pre-sorted, in contrast to the moldy and cracked kernels that they must clean, sort, and grade.

Market prices shift due to market supply and demand, but market premiums, according to the buyers interviewed, are influenced only by offers from brokers and large companies. Even then, smaller aggregators respond differently to premiums offered for quality and volume. Small aggregators have limited storage capacities and market capital to absorb supply. They also have limited price information (especially during busy market days) on which to make decisions about the prices and premiums to pay suppliers.

Large companies that can act as potential groundnut market power brokers (such as Avnash and Project Peanut Butter [PPB]), have not started domestic purchases at scale. These large buyers can demand and influence the market supply of aflatoxin-safe groundnuts.

The study found no market premium for aflatoxin-safe groundnuts. However, there is a clear premium for clean, sorted, and graded groundnuts, which may be taken as an imperfect proxy for aflatoxin-safe groundnuts. The study recorded an average price difference in the 2014/15 market year between low- and medium-quality groundnuts of up to 50 GHS per 100 kg maxi-bag. For high-quality premium groundnuts, large buyers pay up to 85 GHS more than for medium-quality groundnuts.

Large end market buyers, who typically set domestic prices for quality groundnuts, have expressed interest in market engagement for aflatoxin-safe groundnuts. However, they specified that reliable and verifiable information sources and data collection would be prerequisites. They also explained that strong legislation and enforcement were needed to ensure the regulation of aflatoxin-safe markets, and to guarantee sustainable premium fixing.

Recommendations

The study showed that the adoption and marketing of aflatoxin-safe groundnuts requires an innovative strategy, aimed at strengthening the role of the aggregators as a strategic link between producers and consumers. To implement the strategy, the study recommends, as a prerequisite, the following actions:

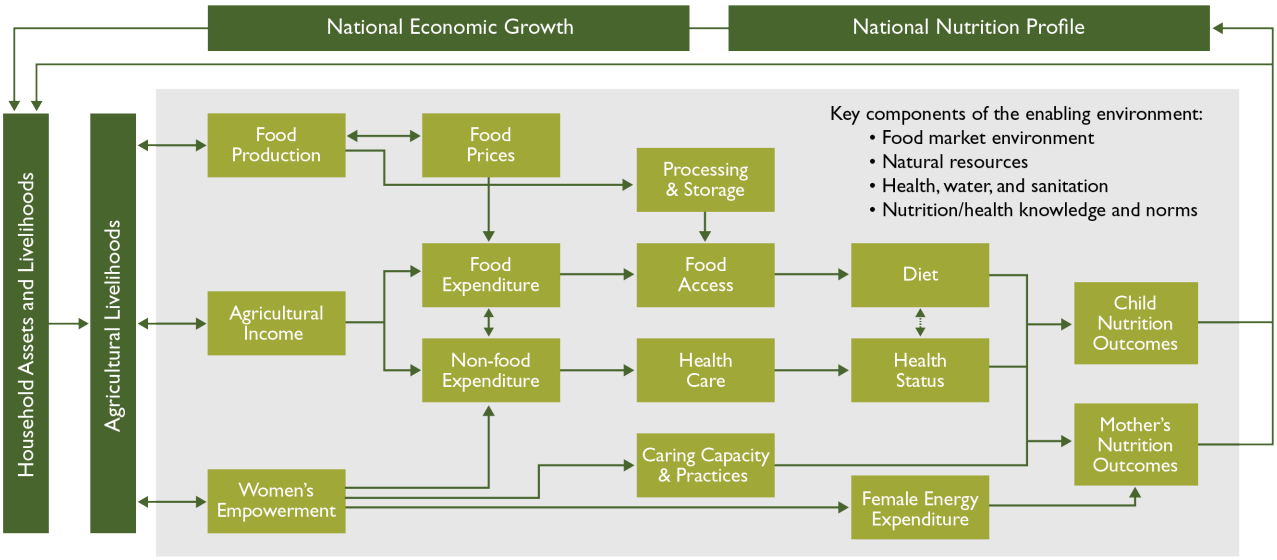
1. Produce a detailed mapping of groundnut market aggregators.
2. Support innovative mass education and awareness campaigns on high-quality standards, fair market prices, and aflatoxin-safety standards and regulations.
3. Improve aggregators' attitudes and marketing practices using awareness-raising and educational sessions that will enable transparent pricing practices and incentivize farmers to use good agricultural practices.
4. Organize and conduct intensive training for all aggregators on testing aflatoxin levels and preventing recontamination.
5. As part of the start-up activities for aflatoxin-control, provide smart subsidies for aggregators to acquire simple and affordable on-the-spot aflatoxin testing kits.
6. Strengthen aggregator associations and unions to promote self-regulation and their capacity and power to abide by aflatoxin safety regulations, by discounting or rejecting low quality groundnuts from suppliers in the primary (community and district) markets and near-end (regional) markets.
7. Improve the capacity of state regulatory bodies on aflatoxin-control and invest in equipment and facilities to support and regulate aggregators' activities.

This report is one of three studies by SPRING on aflatoxin contamination in northern Ghana. The others are "Ghana: Cohort Testing for Aflatoxins in Groundnuts" and "Ghana: Testing for Aflatoxins in Maize: Aflatoxin testing among maize aggregators in northern Ghana."

Introduction

SPRING/Ghana's overarching vision is to prevent stunting and reduce anemia in the Feed the Future (FTF) zone of influence in fifteen districts in the Upper East and Northern Regions. We have developed a 1,000-day household approach, which focuses on households with pregnant and lactating women and children under the age of two, and have identified behaviors across the nutrition, water, sanitation, and hygiene (WASH), and agriculture that can contribute to improved nutrition outcomes.

Within the agriculture sector, our package of interventions follows the conceptual pathways between agriculture and nutrition (Herforth and Harris 2014).



Aflatoxins are an important factor in food production and child nutrition outcomes. A naturally occurring toxin produced by the fungus Aspergillus, aflaxtoxins are found across the world and affect staple crops, such as maize, rice, cassava, groundnuts, chilies, and spices. In the human body, they impede protein and fat digestion and absorption and impair carbohydrate breakdown, leading to decreased motility and diarrhea, which in turn increases the risk of stunting. Aflatoxins are also associated with teratogenic effects (i.e., birth defects), among other conditions, including increased risk of cancer. Aflatoxicosis can be either acute or chronic, and while adults generally have a high tolerance in acute cases, children are at an increased risk of death. An estimated 4.5 billion people worldwide are at risk of chronic exposure. SPRING is working to reduce the risk of stunting due to the environmental enteric dysfunction (EED) caused by the presence of aflatoxins in the intestines.

As the pathways diagram indicates, the production of aflatoxin-safe groundnuts would increase market prices paid for aflatoxin-safe nuts. The pathways show that agricultural income increases due to price premiums could have a positive impact on nutrition outcomes. This study focuses on aggregators (buyers) of groundnuts from the farmers with whom SPRING is working to grow aflatoxin-safe groundnuts. Another emphasis was placed on near-end markets in the groundnut production regions of northern Ghana and end markets in southern Ghana (Tamale, Bolgatanga, Techiman, and Kumasi). The primary focus was on the near-end market and end markets of groundnuts because they are the principal market brokers who determine prices and premiums (FAO 2014).

The marketing and pricing of groundnuts is still dominated by many small aggregators at the district level and a few medium-sized aggregators in the near-end and end markets in the groundnut value chain (Angelucci and Bazzucci 2013; Atuahene-Amankwa et al. 1998; Ibrahim and Florkowski 2015).

Purpose and Objectives

Purpose

The purpose of this study was to understand the factors that influence aggregators' willingness to pay price premiums for aflatoxin-safe groundnuts. By identifying the factors that influence those who buy groundnuts, SPRING hopes to contribute to understanding how to improve groundnut quality and to reduce environmental enteropathy and the negative side-effects of consuming aflatoxin-contaminated groundnuts, which are an important element of the Ghanaian diet and are frequently grown by women.

Objectives

The study objectives were to—

1. collect and analyze quantitative data and qualitative information on market prices and premiums on aflatoxin-safe groundnuts
2. document the research process and methodology
3. determine influential and sensitivity factors that affect market prices and premiums
4. assess aggregators' willingness-to-accept or pay market prices and premiums
5. recommend strategies and follow-up actions for marketing aflatoxin-safe groundnuts.

Processes, Outputs, and Outcomes

The research question, which asks if those who buy groundnuts would value an aflatoxin-safe product, focused on key issues related to market premiums; i.e., can groundnuts that are proven to be aflatoxin-safe command a higher price. It also examined the principal issues that are key factors/drivers of market prices and premiums in near-end and end markets, and the constraints/challenges to adopting market premiums, as well as incentives and associated risks and mitigation. Using a standard price sensitivity analysis, the study assessed the dynamics of near-end and end markets for aflatoxin-safe premiums.

A total of 21 aggregators in four near-end markets and three end markets were surveyed to assess their willingness to adopt price mechanisms that could reduce exposure to aflatoxin in groundnuts. It also determined their willingness-to-pay an aflatoxin-safe premium on groundnuts. The analysis was then used to identify and understand issues of transparency in designating fair prices for aflatoxin-safe groundnuts and issues/actions that influence aggregators in accessing premium markets.

Literature Review

Groundnut Production and Value Chain

a) Groundnut Production in Ghana

Groundnut (*Arachis hypogaea* L.) is a major food legume in Ghana. On average, 530,000 metric tons (MT) were produced on an area of 333,000 ha in 2010 (Choudhary and D'Alessandro 2015). The crop is produced in all agro-ecologies of the country, with most of the production in northern Ghana, in the Northern, Upper East, and Upper West Regions, spanning the Guinea and Sudan savannah ecologies lying within latitudes 8˚ and 11˚ north of the equator.

In general, groundnuts are the second most lucrative crop in Ghana. In the north, more than 625,000 households (both large and small landholders) produce them. Women mainly grow the crop in the north, with variations in variety, acreages, and volumes produced or marketed across districts and regions (Zuberu et al. 2013). Groundnuts are used as a weaning food, an ingredient in many Ghanaian dishes, a snack food, and a high-quality cooking oil, especially suited for frying because it has a high smoke point (Zuberu et al. 2013; N'dede et al. 2012).

Groundnuts are important for meeting household protein needs, but even the poorest farmers grow them as a cash crop. Groundnut production is mainly rain-fed and labor intensive, with about 94 percent of production in northern Ghana, where families do most of the labor. Labor sharing (in-kind) is practiced to meet labor shortages during the planting and harvest seasons. Women provide most of the labor (Zuberu et al. 2013; N'dede et al. 2012).

Groundnut processing into three key products—oil, paste, and snacks—is mainly artisanal. Processing into paste and oil is primarily done in northern Ghana and marketed in urban centers of southern Ghana (DFID, 2014). Processing into edible snacks (roasted groundnuts) is done equally in northern and southern Ghana; roasted groundnuts are prepared and sold with plantains and bananas, or with cereal porridge (*koko*) by small-scale vendors, drawn principally from the north (Zuberu et al. 2013).

Other key players in the groundnut value chain include itinerant traders and emerging organized aggregators who buy for merchants based in Techiman. Reports indicate that formal processing has always been dominated by a few large-scale processors (e.g., SAVNAB, Ghana Nuts). The major edible oil mill in the north is closed and awaiting rehabilitation by Avnash. Previously, a few organized producers existed in the north. The Department for International Development (DFID) reported that new snack manufacturers in Accra, in addition to the producers of *Nkatieburger* snacks, are producing coated groundnuts. Large-scale oil millers based around Techiman have also started doing business (DFID 2014; Angelucci and Bazzucci 2013).

In Ghana, DFID (2014) reported that approximately 92 percent of national production comes from the north. From 2005–2010, groundnut exports were negligible, and most of the production was for domestic demand. Total production increased gradually from 209,000 MT in 2000 to 530,887 MT in 2010, mostly grown by small landowners. A more rapid rise in production was seen from 2010 to 2013 (DFID 2014) (Ghana Ministry of Agriculture 2014; Quiñones and Xinshen 2011; Awuah et al. 2006). Table 1 presents a snapshot of groundnut production, consumption, imports, and exports.

Table 1. Annual Production, Consumption, Exports, Imports, and Balance, 2000–2014

Volume (MT)	2000	2005	2007	2009	2010	2011	2012	2013	2014
Annual production	209,000	226,762	348,726	485,100	530,887	561,097	558,043	578,803	534,234
Annual consumption	155,347	178,880	279,453	398,596	436,502	475,155	476,148	495,768	457,593
Exports *(mainly to Ivory Coast, Liberia, and the EU)*	4,807	5,313	8,519	10,892	13,074	12,905	13,560	14,644	11,342
Imports *(mainly from Burkina Faso and Togo)*	10,120	13,326	16,205	21,593	17,881	18,218	23,797	28,604	19,861
Balance of production *(carried over to next year)*	68,580	66,522	93,997	118,989	125,339	117,065	119,252	126,283	107,844

Source: Assembled with data from MOFA 2012; Quiñones et al. 2011; and DFID 2014.

The balance of groundnut production from 2000 to 2014 (Table 1) shows that if exports were sent to the European Union (EU) and other international markets, there would still be enough for the emerging oil mills and other products (paste/butter, snacks, seed).

Masters et al. (2013) reported that traders and aggregators indicated that obtaining a good, regular supply of groundnuts is their key priority; a reliable income is their second greatest priority. Aflatoxin-safety, on the other hand, is not as important to them. Reports in Benin suggest that this attitude may be due to lack of understanding of the dangers of aflatoxin contamination (Angelucci and Bazzucci 2013; FAO 2002).

b) Groundnut Value Chain

An agricultural value chain is an entire system of agricultural production, processing, and marketing—from planning, inception, and extension services, to the final harvested produce. It comprises a series of value chain actors, including farmers, traders, processors, wholesalers, retailers, and consumers, who are linked by flows of products, finance, information, and extension services. Supporters, such as government regulators, financial institutions, research and extension agents, and transporters provide various services to the chain (FAO 2014).

Ghana's groundnut value chain extends from planning, to production, through to marketing and regulation (Florkowski and Kolavalli 2013; FAO 2014). At each point in the groundnut value chain, specific individuals work to sustain the chain. In northern Ghana, the recognizable components of the groundnut value chain are the production and marketing sub-systems (FAO 2008; BFAP 2012). This study placed emphasis on the groundnut marketing value chain and its attributes (aggregation, aggregators, market prices, market premiums, price sensitivities, and willingness-to-accept/pay market prices offered in the markets).

Florkowski and Kollavali (2013) reported that the prevailing substantial cost of aggregating from the farm gate to the regional markets in the north was due to the small size of farmers' plots and the cost of transport on poor roads. The Food and Agricultural organization (FAO) also reported, and other studies indicated, that the large mark-up (of about 75 percent) between groundnut price in Tamale and consuming centers in southern Ghana could not be explained by transport and handling costs alone (Mitchell 2003). It was probably caused by high post-harvest losses and a large number of intermediaries (aggregators and vendors).

Aflatoxin Safety and Groundnuts

Aflatoxin, a secondary metabolite of a fungus (*Aspergillus flavus),* suppresses the immune system of humans and animals, especially growing children, sick people, and the elderly. Florkowski and Kolavalli (2013) reported that aflatoxin contamination is a serious economic threat. It reduces the price value of agricultural products by causing mold and secondary damage or infections in stored food crops, particularly maize, groundnuts, and most staples in Ghana and other parts of Africa (Jolly et al. 2009).

High levels of aflatoxins in groundnuts may render them unacceptable for sale, causing financial loss to the farmer or retailer (Oliveira et al. 2009). Aflatoxin-producing fungi also cause direct economic losses by lowering the quality of the product, which reduces the price (discounts). Aflatoxin contamination has affected not only groundnut farmers but also groundnut traders and other users in the groundnut value chain. Reports of high aflatoxin contamination have limited African producers' access to high-value markets in the EU. Researchers recommend that all parties involved in the process of producing and marketing groundnuts ensure that contamination from mycotoxins is minimized as much as possible (Revoredo-Giha and Fletcher 2005; Yentür et al. 2006).

Aflatoxin contamination can occur in the field before harvest, as well as during harvesting, threshing, drying, transporting, and storing (Dohlman 2003).

Acceptability levels of aflatoxin contamination vary. The World Health Organization (WHO) set a maximum level for aflatoxin at 20 parts per billion (ppb) in human food and 100 ppb in animal feed. The EU set stricter standards; any food products with a concentration of aflatoxin higher than 4 ppb cannot be sold (Amoako-Attah 2007). Regulators in the United States limit contamination to 16 ppb (FAO 2014; Revoredo-Giha and Fletcher 2005; Yentür et al. 2006; Waliyar et al. 2014).

Aggregation and Markets

Aggregation refers to activities of smallholder traders and vendors in Ghana who assemble and sell in bulk various commodities for storage, price speculation, and onward sales to large buying companies (Mitchell 2003). These smallholder traders are often referred to as *aggregators* because of the key roles they play in the groundnut value chain—their aggregation function and scale, and their market position. Previous studies (FAO 2002) classified them as source market aggregators (SMAs), near-end market aggregators (NEMAs), and end market aggregators (EMAs).

Aggregators' markets classified as *source/primary markets* are often most prevalent in community and district markets that are located at the district level. The near-end markets are described as secondary-level markets where aggregators are usually seen as medium-scale traders. The USAID-funded Agricultural Value Chain Management Project (AVCMP), the International Fertility Development Corporation (IFDC), and Alliance for Green Africa (AGRA) described tertiary-level markets as *end markets*, which are seen as large-scale markets—for example, in Tamale, Techiman, and Kumasi (Angelucci and Bazzucci 2013).

Another category of key actors who are assumed to be *price givers* were called *end market decision makers* (EMDMs) (Angelucci and Bazzucci 2013). In the future, agricultural value chains are likely to focus on developing the groundnut value chain based on the emerging concept of SMAs, NEMAS, and EMAs because of increasing foreign direct investment in Africa's agriculture (Revoredo-Giha and Fletcher 2005).

Quality Control and Improvement Practices

Quality control and improvement practices have made strides over the last two decades in response to concerns about foreign restrictions or bans on Ghanaian groundnuts due to aflatoxin contamination (Angelucci and Bazzucci 2013; Smith et al. 2000).

Florkowski and Kolavalli (2012) reported that buyers expressed preferences for three groundnut attributes: color, kernel size, and oil content. All three categories of aggregators paid the most attention to verifying color, indicating that the color of the groundnut kernel influenced market prices, and more likely, premiums. Although few aggregators are aware of aflatoxin, the use color as a measure of quality plays an important role in aflatoxin control in the groundnut value chain because it eliminates at least some of the potentially contaminated groundnuts from the traded batch (FAO 2014; Waliyar 2014).

Yëntur et al. (2003) report that prevailing marketing practices—particularly cleaning, sorting, and grading methods—in Ghana's groundnut value chain are beset by many challenges, including limited resources and a lack of institutional capacity to control and enforce food quality regulations. Seemingly inferior kernels, which are likely contaminated, are separated out, but the rejects are not removed from the food system. Instead, they are offered to consumers in a crushed form as an ingredient for cooking and flavoring. Tests for aflatoxins confirmed high levels of contamination, particularly in products that contained crushed groundnuts (FAO 2014; Dohlman 2003).

In Benin, Ndede et al. (2012) recommended that the best way to improve the knowledge and understanding of aflatoxin safety and market premium among producers and traders was mass education and training for aflatoxin-safe groundnut marketing (including cleaning, sorting, and grading) along the groundnut value chain.

Market Prices and Pricing Systems

Market Segmentation and Prices

The European Union is the largest market for groundnuts, comprising 43 percent of global demand (DFID 2014; Jolly et al. 2006).

Ghanaian groundnuts are sold mainly in traditional markets. Per capita consumption of groundnuts is high—at 12 kg—and it has been increasing rapidly with rising incomes. According to some reports, the price of groundnuts has increased by 13 percent from 2005 to 2015. Total production was approximately 475,100 MT in 2012, mainly produced in northern Ghana—which accounts for approximately 74 percent of total groundnuts consumed in urban areas (Zuberu et al. 2013; DFID 2014).

Groundnut market segments include unroasted groundnuts, processed groundnuts, coated groundnut snacks, and edible groundnut oil. All segments are growing, but the fastest growth is in processed groundnut products, especially coated snacks. Approximately a quarter of groundnut production now goes toward processing (Angelucci and Bazzucci 2013).

Market Regulations and Practices

Ndede et al. (2012) confirmed from studies in the Republic of Benin that fair profits influenced and motivated various actors in value chains to adopt and implement effective regulations and practices that improve quality and increase aflatoxin safety. In Ghana, an analysis of incentives and disincentives in groundnuts conducted by Angelucci and Bazzucchi (2013) found that supply and demand forces always influence markets and prices.

In an assessment of Ghana's peanut value chain, Masters and other researchers at Tufts University (Masters, et al. 2013) reported that, on the local scene, aggregators fear unfair prices when big-time brokers and

import/export companies enter their markets and control or unduly influence their profit margin (speculation) (MOFA 2013). The benefits of the value chain approach and market price analysis can significantly contribute to marketing and market premiums (Kollavali and Florkowski 2013).

In some districts in Ghana, it has been reported that the use of cell phone-based market information has improved pricing and market efficiencies. Using a cell phone-based market information system (such as Esoko[1]), many aggregators, traders, and farmers are able to access market prices and post bids and offers. The market information systems have allowed traders and aggregators to respond to market signals (e.g., to buy in areas of surplus), and by extension, ensures quality control improvement (Zuberu et al. 2013).

Market Premiums and Willingness-to-Pay

According to Florkowski and Kollavali (2012)**,** there are two types of transactional markets for paying or accepting market prices. For products or goods, these are the preparedness to pay or accept and the willingness to pay or accept market prices. According to FAO (2014), there are differences between the preparedness and the willingness to pay or accept market prices.

The preparedness to accept or pay (PTAP) is based on the value of the product. It is also guided by factors that include economic/financial benefits, social and other external factors—bargaining, negotiation skills, etc.—that determine the value of the product, goods, or service (Ghana Ministry of Agriculture 2012). PTAP is described as potential, latent, intrinsic or internal, and precedes willingness to accept or pay; i.e., the I-have-the-money/capacity-to-buy/take-the-undesirable (FAO 2014).

The willingness to accept or pay (WTAP) is a product of PTAP, which is based on dynamics and kinetics determined by an aggregator's resources (financial, logistical, etc.). Zuberu et al. (2013) reported that some socio-ethno-cultural underpinnings are responsible for the differences between PTAP and WTAP. Therefore, some reports recommend examining and assessing the potential effect of socio-ethno-cultural attitudes to determine groundnut market prices and premiums in its zone of influence (Moss 1998).

Even though a chaotic market pricing system is currently the norm, many key actors in West Africa anticipate the establishment and monitoring of fair market prices and premiums for all traded crops, particularly groundnuts and other aflatoxin-susceptible produce, in the near future (MOFA 2013; Moss 1998).

Preparedness and Willingness to Accept or Pay (PWTAP)

WTAP is the minimum amount of money that a person is willing to accept to abandon something good or to put up with something negative (Smith et al. 2000)

In this case, preparedness and willingness to accept (PWTA) is the minimum market price that an aggregator or end market decision maker is prepared and/or willing to accept as a negotiated price of groundnuts—sometimes lower than the prevailing market price—or to pay a market price higher than the prevailing market price. The decision could be guided by factors other than economic or financial considerations. An aggregator may be willing to accept lower prices as a result of sociocultural issues, such as earlier favors, or family support ties between producers and buyers.

[1] Esoko is a is a multi-currency, multi-commodity, market information system (MIS) and is classified as agricultural informatics or e-agriculture. Esoko provides farmers and traders with market information, such as prices, and a platform for advertising and negotiating buy/sell offers. On the Internet, Esoko provides pricing and buy/sell information to all users and serves as a platform for organizations that want a presence on the World Wide Web. On mobile telephones, Esoko registers members that have requested to receive short-message system (sms) alerts of commodity market prices and offers to buy/sell.

In most cases, aggregators are unwilling to accept discounted prices (i.e., prices lower than prevailing market prices), unless the groundnuts are of lesser quality than the groundnuts sold at the prevailing market price (Angelucci and Bazzucci 2013; FAO 2014).

Aggregators' preparedness and willingness to pay (PWTP) for a product of specific qualities, at any prevailing price, is said to be determined or influenced by the prevailing market forces: supply, demand, volume/quantity, price shifts, etc. The PWTP is described as the highest price an aggregator is willing to offer to procure a product or good, or to consciously sacrifice or avoid something undesirable (Zuberu et al. 2013). The market price (also referred to as transaction price) of any good was, therefore, any point between an aggregators' preparedness and willingness to pay and a sellers' preparedness or willingness to accept. The net difference between willingness to pay (WTP) and willingness to accept (WTA) is the social surplus created by trade (Angelucci and Bazzucci 2013; Zuberu et al. 2013).

Methods of PTAP and WTAP Measurements

Several methods have been developed to measure aggregators' willingness to pay or accept the market price of groundnuts. These methods can be divided into whether they measure aggregators hypothetically or measure an actual willingness to pay or accept, and whether they measure willingness to pay or accept directly or indirectly (Angelucci and Bazzucci, 2013).

Choice modeling techniques were also applied to estimate the value of the WTP or WTA in the situation where u (p, x) is an individual aggregator's price utility function (PUF), where w is the aggregator's offered price, and x is a dummy variable that takes the value of 1 (one) in the presence of an undesired offered price and takes the value 0 (zero) in the absence of that desirable price. The price utility function (PUF) is assumed to be increasing in p and decreasing in x; and it is also defined w_0 as the aggregators offered price (Zuberu et al. 2013; Kahneman and Tversky 1979).

Research Approach, Methodology, and Tools

Research Approach and Process

The study analyzed participation and willingness of aggregators to adopt and sustain market premiums on groundnuts. Other issues included how market actors respond to changes, shifts, and fluctuations in prices of aflatoxin-free/safe groundnuts. Research focused on key economic and market sensitivity issues on groundnut markets and aflatoxin safety.

The major background issues examined included market prices and premiums, incentives, and their price risks. Using a standard price sensitivity analysis, the study assessed the feasibility of local and regional end markets adopting and sustaining market premiums on groundnuts.

Twenty-one aggregators were surveyed to collect relevant data that would determine their willingness to pay an aflatoxin-safe premium on groundnuts. Key issues of transparency in designating safe groundnuts were analyzed, including the salient barriers that confront market actors in accessing the premium market. Practical steps were identified to promote the adoption of market premiums and incentives, as well as to facilitate and sustain access and benefits.

The study used timely research reports and other works published and disseminated by the Peanut and Mycotoxin Innovation Lab (PMIL) at the University of Georgia. Important findings and recommendations on aflatoxin-related activities in Ghana were also reviewed. Relevant key actors in the groundnut value chain were identified, and a list of aggregators who could potentially adopt or sustain market premiums on groundnuts was compiled (Table 3A).

See Annex 2 for a detailed description of research approach, methodology, and tools.

Research Type and Approach

The study assessed an aflatoxin-safe premium at the local and regional end markets using a price sensitivity analysis, based on a small sample of formal near-end and end market aggregators to determine their willingness-to-pay an aflatoxin-safe premium on groundnuts. The research assignment was an *applied research consulting* and/or *applied research development* activity. The research approach was iterative in nature, form, and process. It was intended to produce satisfactory evidence that would provide reliable information and research outputs for entry into and/or continuation of premium-based interventions. The research focused on medium and large aggregators of groundnuts in Ghana, from near-end market aggregators in Tamale market (Northern Region), Bolgatanga market (Upper East Region), and Techiman market (Brong Ahafo Region), as well as a reliable and credible end market in Kumasi (Ashanti Region).

Research Layout and Design

The experimental research design is adapted from a randomized complete block design (RCBD) for observational analysis of a 4 x 2 x 2 market price analysis. Using a simple randomizing technique, detailed quantitative data and qualitative information from primary and secondary sources were collected from 21 medium- and large-scale aggregators.

The data and information collected were based on demographic information, markets (distribution, varieties, scale of aggregation, market prices), and price sensitivity analysis, as well as factors related to market premium (variety, scale, capacity, and willingness to pay).

Four categories of independent variables were measured, including (a) four price points, (b) two scales of aggregation, and (c) two groundnut varieties.

The dependent variables were (a) factors on market premium (effect/influence of independent variables) and (b) validity tests (statistical tests of validity of independent variable).

The study utilized quantitative information on varieties, scale, and prices, and qualitative information on knowledge and perceptions of market premiums, as well as market price facilitators that included incentives, disincentives, facilities, regulative measures, etc.

The research outputs were (a) qualitative outputs, (b) price distribution and seasonality (price-over-season), (c) market premium and discounts, and (d) level of specificity or generalization (tests of statistical significance and confidence levels).

Standard processes utilized in applied research covered all the prescribed conventional steps of the research process and methods. These included (a) preparation and planning, (b) design and layout, (c) execution and monitoring, and (d) presentation and dissemination of outputs and outcomes of the research work.

Some research attributes and variables are exempted from the study and do not cover or focus on the salient parameters for the expected outputs. The design was restricted to an adapted RCBD for observational analysis of the 4 x 2 market price analysis.

Independent variables that were exempted from the study included (a) production (good agricultural practices), (b) rainfall years (wetter or drier rainfall years), (c) volumes (quantities of aggregations or marketing), (d) quality (cleaning, sorting, and grading), (e) uses (crushing, confectioneries, etc.), (f) incentives and disincentives, and (g) supportive regulation measures.

The dependent variables exempted were (a) practices (production, post-harvest, storage, transportation, etc.), and (b) market trends (production, volumes, quality, imports, exports, etc.).

Research Methodology and Tools

Method of Analysis

The method of analysis and the standard conventional steps taken were applied to ensure consistent analysis. These steps included applying select statistical, analytical, and econometric models for determining the feasibility and adoption of market-based premiums for aflatoxin-safe groundnuts.

Research Models, Tools, and Techniques

The study employed econometric methods to obtain verifiable findings, recommendations, and conclusions. Summaries of the selected analytical models and tools/techniques are presented in the following sections.

a) Enterprise Budget Analysis

An enterprise budget analysis was used to determine market premiums and the associated behaviors and actions of groundnut aggregators in SPRING's zone of influence.

The study used modeling techniques to assess the impact of market premiums on the choices of aggregators and decision makers in selecting groundnut characteristics and market locations. In the end, enterprise budget analysis was applied to identify key shifts, responses, and values responsible for market premium risk and vulnerability assessment in Ghana's groundnut market premium price shift planning and insights in areas affected by the groundnut market value chain and economy.

The outputs of the enterprise budget analysis process (Table 1) were used in other related research tools to validate the outcomes of the study on market premium characterization and price shifts, as well as the responses of aggregators (end and near-end) to their preparedness and willingness to accept and/or pay market premiums on aflatoxin-safe groundnuts.

The final expected output of the enterprise budget analysis was, therefore, to contribute to SPRING's understanding of the effects of the market premium on aflatoxin-safe groundnuts in northern Ghana. This was achieved by examining, identifying, and explaining the observed differences in variables and observations in the shifts in market prices from the 2013/14 to 2015/16 groundnut seasons.

b) Partial Budgeting

Partial budgeting was applied as a planning and decision-making framework. It compared the costs and benefits of alternatives faced by a farm business, but it only focused on the changes in market prices if a specific alternative was implemented (Moss 1998). Applied in the market premium study here, the partial budgeting evaluated the impact on the aggregators' profit resulting from price changes during the market year (the four quarterly price points and the independent variables).

c) Conventional and Premium Price Sensitivity Analysis

For the price sensitivity analysis (also known as price elasticity of demand), the study examined the degree to which aggregators' behaviors and sensitivities were affected by the changes in the market price of groundnuts. The price sensitivity analysis enabled the study to examine their perceptions, attitudes, and behavior to help them make good decisions about the prevailing market prices of clean, sorted, and graded aflatoxin-safe groundnuts.

An important challenge was the absence of critical information on what is willingly being paid by the aggregators and consumers. Pricing strategies depend largely on the judgment of the NEMAs and end market firms, rather than data-driven empirical evidence to determine the impact of distinctive pricing levels on demand for groundnuts, and particularly on the market premiums of aflatoxin-safe groundnuts (Angelucci and Bazzucci 2013).

Standard Analytical Tools

The two tools used for analysis were the Statistical Package for Social Sciences (SPSS) and Statistical Analysis Software (SAS). SPSS was used to determine the qualitative information attributes and SAS was used to perform searches and transform and manage data needed to meet both specialized and enterprise-wide statistical needs of determination of market premiums of aflatoxin-safe groundnuts. Additionally, the study applied high-performance modeling tools for complete and comprehensive data analysis techniques. These provided accurate statistical results based on graphical user interfaces.

Market Price Sensitivity and Risk Analysis

A simulation tool—the Monte Carlo @RISK ("at risk") software—was applied for the market price sensitivity and risk analysis. It was developed for a price sensitivity risk analysis in a spreadsheet model, using a Monte Carlo simulation to show trends in market price sensitivity, possible risk outcomes, and their probability of occurring.

The software was applied to mathematically compute and track two possible future scenarios in end and near-end groundnut markets in northern Ghana. It then presented the probabilities and risks associated with each scenario. From output, the study determined the best decision-making options under uncertainty, thus evaluating the risks to take or to avoid.

Risk management strategies were planned and analyzed using the @RISK model by integrating a "RISKOptimizer," which was used with the Monte Carlo simulation to optimize spreadsheets with uncertain values. It was then used to determine the best allocation of quotas for market premium prices, based on the dependent variables.

The RISKOptimizer was applied to determine the level and uncertainty of risk that is hidden in volatility and uncertainty of market premium prices that groundnut supply-and-demand chain actors encounter.

Data Collection

Data collected were based on pre-determined independent and dependent variables.

General demographics and aggregator characteristics

The datasets collected pertained to the market location (town/city), name of aggregator, telephone contact, scale of aggregation (low/high), source of groundnuts (small/markets/ large markets), destination of groundnuts (small/markets/large markets), and the capacity of the haulage trucks (small/medium/large).

Storing, cleaning and sorting, marketing practices, and plans for improvement

The datasets collected under this section pertained to quality assurance practices, including storing, cleaning, and sorting groundnuts (damaged, peeled, cracked groundnuts), as well as purchasing and buying characteristics, and other marketing practices.

Premiums by/for aggregators in end and near-end markets and decision makers

The datasets collected were based on the aggregators' knowledge and practices in market premiums in end and near-end markets (in Tamale, Bolgatanga, Techiman, and Kumasi). Data were also collected on decision makers (large firms that are not aggregators, but have the power to influence premiums).

Groundnut value chain actor budgets, profitability, and risks

The datasets were based on budgets, profitability, and price risks for analysis of profitability and associated sensitivity, and premium risk management.

Willingness, commitment, and sustainability on market premium in groundnuts

Datasets were collected to determine the preparedness, willingness, and commitment of aggregators and decision makers to pay or accept premiums. The data collected were applied to the analysis of sustainability of the market premium on groundnuts.

Data Analysis

Data were cleaned, validated, compiled, and entered into the two software programs (SPSS and SAS). After the data were compiled, they were subjected to statistical analysis using the SPSS software. The SAS program was then used to estimate a function that relates market prices (dependent variables) to the market/commodity characteristics, including quarterly seasonality, abundance and scarcity, and location and distance.

The resulting function measured the portion of the market premium that is attributable to each characteristic. The study regressed the market price of groundnuts based on its assumed aflatoxin-status, and other attributes/variables to determine the value of each contributory attribute by examining the price changes, shifts, and trends in each of four seasons (quarters) over the three years (2013/14 to 2015/16).

In summary, the study applied the Hedonic Partial Model (HPM) to evaluate the contributory value of the attributes of market prices and premiums in order to perform a cost-benefit analysis to guide the fixing of fair and sustainable premiums.

It should be noted that the HPM analysis may have been overly complicated because too many factors and attributes were included—such as price shifts (the relationship between price and characteristics of an agricultural commodity), which could be non-linear in situations where market prices increase at variable rates

when the market characteristics and/or commodities' attributes change. Also, several variables could be correlated, resulting in corresponding shifts and changes that eventually influence the final value of the market premium. In such non-linear situations, different functional forms and model specifications for the HPM analysis would have been considered.

For the study, a linear HPM analysis was used to avoid potential complications of non-linearity generated by the excessive data collected. This challenge was addressed by reducing the number of attributes and variables.

Findings

General Demographics and Aggregator Characteristics

There are four markets: two near-end markets in Tamale and Bolgatanga, and three end markets in Tamale, Techiman, and Kumasi. There were 12 NEMAs: seven in Tamale and five in Bolgatanga. (See Annex 3 for the focus group discussions checklist.)

Medium scale near-end market aggregators (all women):

- 5 out of 21 medium-scale near-end market aggregators (23.8 percent) in Tamale.
- 4 out of 21 medium-scale near-end market aggregators (19 percent) in Bolgatanga.
- There were nine large-scale (end market) aggregators in Tamale, Bolgatanga, and Techiman; four large-scale (end market) aggregators in Tamale; and four medium-scale (near-end market) aggregators in Bolgatanga. All six end market aggregators in Techiman were large-scale aggregators (two female and four male).

Table 2. General Demographics and Aggregator Characteristics

Aggregators Surveyed in Northern Region		
Gender	**No. of Aggregators**	**Percentage (%)**
Men	4	50
Women	4	50
Total	*8*	*100*
Scale	**No. of Aggregators**	**Percentage (%)**
Medium-scale: Men	0	0
Medium-scale: Women	4	50
Large-scale: Men	1	12.5
Large-scale: Women	3	37.5
Total	***8***	***100***

Aggregators Surveyed in Upper East Region		
	No. of Aggregators	**Percentage (%)**
Men	2	28.6
Women	5	71.4
Total	*7*	*100*
Scale	**No. of Aggregators**	**Percentage (%)**
Medium-scale: Men	0	0
Medium-scale: Women	3	42.8
Large-scale: Men	2	28.6
Large-scale: Women	2	28.6
Total	***7***	***100***

Markets	No. of Aggregators	Percentage (%)
Near-end markets	4	50
End markets	2	25
End market decision makers	2	25
Total	***8***	***100***

Markets	No. of Aggregators	Percentage (%)
Near-end markets	4	57.1
End markets	3	42.9
End market decision firms	0	0
Total	***7***	***100***

Source: *Prepared from field survey information, furnished by aggregators, March 2016*

Table 3 displays the relevant information on the address of store, scale of aggregation, and the most common groundnut varieties.

Table 3. Aggregator Participants in Focus Group Discussions and Key Informant Interviews

Store No.	Name of Market Store	Scale of Aggregation	Monthly Volumes		Variety (most common varieties)
			Scale (MT) (min) *during Low Harvest Years*	**Scale (MT) (max)** *during High Harvest Year*	*Note: Most aggregators are somewhat aware of sources of seeds, traits, tolerance, or resistance to pests and diseases*
Market Location: *Tamale Aboabo. Regional Groundnut Aggregators Market. Northern Region*					
1	Abukari Mairey Store	Medium	15–25	25–35	Bugla, Abain, Simbalgu
2	Abukari Mairey Store	Medium	25–30	40–50	Bugla, Chinese, Abain, Simbalgu
3	Afa Mahaman Store	Medium	15–25	24–30	Bugla, Abain, Simbalgu
4	Muktaru Luufa Store	Medium	25–35	40–50	Bugla, Abain, Simbalgu
5	Hajji Shetu Store	Large	15–25	250–300	Bugla, Chinese, Abain, Simbalgu
6	Hajji Shetu Store	Large	150–300	400–500	Bugla, Manipinta, Simbalgu
7	Ndiego Moosi Store	Large	150–200	250–300	Bugla, Manipinta, Simbalgu
8	Ndiego Moosi Store	Large	150–200	250–400	Bugla, Manipinta, Simbalgu
Market Location: *Bolgatanga Regional Groundnut Aggregators Market, Upper East Region*					
1	Nafisa Luufa Store	Medium	100–150	200–300	Bugla, Sumkarsie/Chinese, Dobba
2	Afa Adam Store	Medium	150–200	250–300	Sumkarsie/Chinese, Sumbalgu, Dobba
3	Afa Adam Store	Medium	150–200	250–300	Sumbalgu, Dobba (Burkina)
4	Adamu Luufa Store	Medium	100–150	200–300	Bugla, Sumkarsie, Sumbalgu, Dobba
5	Mma Kande Store	Medium	100–150	200–350	Bugla, Sumbalgu, Dobba (Burkina)

Table 3. Aggregator Participants in Focus Group Discussions and Key Informant Interviews (continued)

Store No.	Name of Market Store	Scale of Aggregation	Monthly Volumes		Variety (Most common varieties)[2]
			Scale (MT) (min) *during Low Harvest Years*	Scale (MT) (max) *during High Harvest Year*	
6	Kadua Paga Enterprise	Large	150–200	250–400	Burkina (Dobba), Sunkarse (Chinese)
7	ORGIIS Stores Ltd.	Large	250–350	400–500	Sumkarsie, Sumbalgu, Dobba (Burkina)
Market Location: *Techiman Market. Regional Groundnut Aggregators Market. Southern Ghana*					
1	Alhaji Ibrahim Stores	Large	500–800	1,000–2,500	Buglaa (big-size), Chinese (small-size), Manipinta (oil-type)
2	Alhaji Karim Stores	Large	300–500	1,000–2,000	Buglaa (Big-size), Chinese (small-size), Manipinta (oil-type)
3	Maridjanna Moosi Store	Large	500–800	2,000–3,500	Buglaa (big-size), Chinese (small-size), Manipinta (oil-type)
4	Leila Takoradi Stores	Large	500–700	1,000–2,500	Buglaa (big-size), Chinese (small-size), Manipinta (oil-type)
5	Leila Takoradi Stores	Large	200–300	500–1,500	Akaseyie (big-size), Kitiwaa (small-size)
6	Alhaji Musah Stores	Large	200–300	500–1,500	Akaseyie (big-size), Kitiwaa (small-size)

Source: *Prepared from field survey information, furnished by aggregators, March 2016.*

Groundnuts and Aflatoxin-status (production types, varieties, uses, preferences, etc.)

The study found two main groundnut agro-ecological zones: the dry Guinea Savannah in Northern Region and the drier Sahel-Guinea Savannah zones in Upper East Region. The quality of groundnuts depends on how they were produced—by hand or by tractor—and the time of harvesting. There are three main groundnut varieties:[3] *Sinkarzie,* which is most preferred for consumption, followed by the *Chinese* variety and the *Bulga* variety (large and good for snacks). Aggregators preferred the Sinkarzie variety because of its high marketability.

[2] Most aggregators are vaguely aware of sources of seeds, traits, tolerance, or resistance to pests and diseases.

[3] The aggregators' list of groundnut varieties did not match exactly lists from the Savannah Agricultural Research Institute (SARI) and MOFA.

Table 4. Most Common Varieties Marketed by Aggregators (from Upper East Region and Northern Region)

Most Common Varieties Marketed from Upper East Region		
	No. of Aggregators	**Percentage (%)**
Manipinta, Chinese, Sinkarzie	8	38.1
Sinkarzie, Dobba, Chinese	10	47.6
Chinese, Manipinta, Sinkarzie	3	14.3
Total	*21*	*100*

Most Common Varieties Marketed from Northern Region		
	No. of Aggregators	**Percentage (%)**
Bugla, Abain, Simbalgu	12	57.1
Abain, Chinese, Bugla, Simbalgu	4	19.1
Simbalgu, Chinese, Sinkarzie	5	23.8
Total	*21*	*100*

Only five EMAs had heard of aflatoxins, but they did not understand what it was and did not consider it a danger. They were more concerned about avoiding moldy, rotten, or cracked groundnuts—conditions that could be detected through visual inspection.

Aggregators preferred groundnuts produced, harvested, and hand-shelled in the Upper East Region and the dry districts of Northern Region (East and West Mamprusi districts and Bunkpurugu district), where drier conditions lead to fewer moldy and rotten groundnuts than in the moist districts of Northern Region. When shelled by hand, however, groundnuts cultivated in the wetter districts produce much cleaner and less moldy or cracked kernels, and involve less work for aggregators because they have already been cleaned and sorted. The introduction of mechanical groundnut shellers had increased the percentage of broken and cracked kernels, thus reducing acceptable prices and readiness of sale, the aggregators explained.

Aggregation and Markets

During field visits, the researchers did not find any formal or organized groups of groundnut aggregators. Groundnut marketers were either individuals supported by household or family members, or a collection of loosely linked and networked market stalls that trade in relatively large volumes of groundnuts between districts and large markets in Techiman, Kumasi, Takoradi, and Accra.

There were three main transactional categories in the markets surveyed: market types, aggregation markets, and aggregators' enterprises. The three categories are also defined by their size and the volume of groundnuts marketed.

a) Market types

There are three market types. The first type is *primary markets,* also known as *small-sized markets.* These markets are mostly patronized by farmers/producers and small traders/vendors. The quantity of groundnuts traded monthly ranges between 10 and 25 MT per week, or 120–300 MT annually, per aggregator. Aggregators operating in these markets describe themselves as *primary market aggregators* (PMAs). This group/category was not included in the study because they are *price-takers*; i.e., they cannot significantly influence market prices.

The second type is *near-end markets,* often referred to as *medium-scale markets.* They are commonly found at the regional level (e.g., Tamale, Wa, and Bolgatanga in northern Ghana). Aggregators located in near-end markets trade in monthly volumes that range between 50 and 250 MTs per aggregator (or 600–3,000 MT per annum, per aggregator). Aggregators located in the near-end market are referred to as *near-end market*

aggregators (NEMAs). NEMAS have some level of influence on market prices because of their location and their ability to move between the primary markets (at district markets) and end markets (national markets).

The third type are usually referred to as *end markets* and are described as *large-scale markets* because of their wide coverage. Aggregators who operate in end markets, known as *end market aggregators* (EMAs), trade annually in volumes up to 50,000 MT. One or two EMAs can absorb all the marketed groundnuts in one near-end market (e.g., Bolgatanga or Wa) and create an artificial shortage for more than one month (four market weeks). They can, therefore, significantly influence market prices and premiums. They have large storage facilities, working capital, and extensive contacts (big buyers, brokers, etc.). In the Techiman market, the EMAs reported that before the aflatoxin scare, they could easily create and control artificial shortages, raise market prices, and determine premiums in anticipation of the arrival of big buyers and exporters (such as Ghana Nuts Co.). EMAs are therefore seen as *price-givers*; they decide/fix prices for the rest of the groundnut value chain operators.

Another category observed are end-market decision makers (EMDMs), also called *price brokers* because of their ability to determine the overall dynamics of the groundnut value chain in Ghana. It should be noted that the concept of EMDMs in Ghana is just developing. The NEMAs and EMAs speculated that there would be widespread production and marketing of aflatoxin-safe groundnuts as companies and firms like Avnash, SAVNAB, Ghana Nuts Co., and PPB would be able to play a role in determining the market prices and premiums, not only for groundnuts, but for other crops as well.

b) Aggregation markets

Aggregation markets were designated as *source markets* and *destination markets* to describe the sources and routes of aggregation used to assemble and/or distribute bulk.

Source markets are located in the communities and districts where farmers, producers, and traders sell their produce (such as groundnuts). The operators/aggregators do most of the labor in the source markets, where cleaning, sorting, and grading operations improve the quality of the groundnuts and other produce. The products are then marketed to NEMAs who patronize the source markets to assemble bulk and transport large quantities of produce to their near-end markets, mainly in Tamale, Wa, and Bolgatanga (northern Ghana).

Destination markets—the last stop of aggregation—is where the assembled bulk is divided into smaller volumes and quantities for downstream distribution in the groundnut value chain.

In Ghana, the principal destination markets are Accra, Tema, and Takoradi. Lesser destination markets include Kumasi, Konongo, Obuasi, Cape Coast, Koforidua, and Ho. Sunyani is both a source and destination market because it is between and near the groundnut districts of Brong Ahafo Region (Wenchi, Tain, etc.) and the southwestern districts of the Northern Region and Upper West Region and the eastern districts of the Brong Ahafo Region (see Table 5).

Table 5. Source and Destination Markets of Groundnuts in Northern Ghana

Source Markets (Upper East Region)			Source Markets Northern Region)			Destination Markets		
	No. of Aggregators	Percentage (%)		No. of Aggregators	Percentage (%)		No. of Aggregators	Percentage (%)
Mankarigu, Fumbisi	4	19.0	Yendi, Gushiegu, Karaga	3	14.3	Salaga, Techiman, Kumasi, Accra	2	9.5
Putinga (Burkina Faso)	6	28.6	Tamale, Savelugu, Tolon	3	14.3	Kumasi, Takoradi, Cape Coast	3	14.3
Bawku, Garu, Burkina Faso	5	23.8	Yendi, Gushiegu, Savelugu, Tolon	1	4.8	Techiman, Tamale, Ejura, Sunyani	6	28.6
Wa, Burkina Faso	5	23.8	Yendi, Gambaga, Nakpanduri	2	9.5	Sunyani, Mampong, Tema, Kumasi	7	33.3
Navrongo, Kumbisri, Bawku	1	4.8	Gambaga, Walewale	12	57.1	Elimina, Mankasim, Konongo	3	14.3
Total	***21***	***100***	***Total***	***21***	***100***	***Total***	***21***	***100***

Source: *Prepared from field survey data, furnished by aggregators, March 2016.*

Aggregation and distribution routes of near-end and end markets

Aggregation Routes (Source Routes in Northern Ghana)

Aggregation routes varied by region (see Annex 1). Aggregation is dominated by sporadic purchases by wholesalers in open markets, with inconsistent prices and quality. In far reaching areas, itinerant traders rely on spot purchases at the farm gate—assembling, storing, and transporting groundnuts before selling the produce to wholesalers at market prices. Bulking produce is a tedious process, which substantially pushes up the margins for traders. Institutional aggregators, such as processing and marketing companies, prefer to establish contract purchases with aggregators, because contracting and coordinating with farmers can be challenging. The aggregators contract farmers, but on a loose basis of trust. The three regional market centers (Tamale, Bolgatanga, and Wa) serve as transit points, retail centers for near-end aggregators, and wholesale centers for end market aggregators.

Aggregation Routes (Destination Routes: Southern Ghana)

In the middle belt, aggregation is dominated by the Techiman market, which is a large aggregation center for near-end markets and end markets between northern Ghana and southern Ghana. Near-end aggregation in

the Techiman market is dominated mainly by people of northern descent from Tamale, Wa, and Tumu who work closely with the respective southern hubs in Kumasi, Takoradi, and Accra. Aggregators in the groundnut value chain have been known to assemble bulk from traders and farmers and, in turn, supply the large bulk/volume to urban markets in southern Ghana. (See Tables 6, 7, and 8).

Table 6. Source and Destination Markets of Groundnuts in Northern Ghana (Upper East Region), by 21 Aggregators

Source Markets (Upper East Region)	No. of Aggregators	Percentage (%)
Mankarigu, Fumbisi	4	19.0
Putinga (Burkina Faso)	6	28.6
Bawku, Garu, Burkina Faso	5	23.8
Wa, Leo, Burkina Faso	5	23.8
Navrongo, Kumbisiri, Bawku	1	4.8
Total	***21***	***100.0***

Table 7. Source Markets of Groundnuts in Northern Ghana (Northern Region), by 21 Aggregators

Source Markets (Northern Region)	No. of Aggregators	Percent (%)
Yendi, Gushiegu, Karaga	3	14.3
Tamale, Savelugu, Tolon	3	14.3
Yendi, Gushiegu, Savelugu, Tolon	1	4.8
Yendi, Gambaga, Nakpanduri	2	9.5
Gambaga, Walewale	12	57.1
Total	***21***	***100***

Table 8. Destination Markets of Groundnuts in Northern Ghana (Destination Markets), by 21 Aggregators

Destination Markets	No. of Aggregators	Percent (%)
Salaga, Techiman, Kumasi, Accra	2	9.5
Buipe, Kumasi, Takoradi, Cape Coast, Oboasi	3	14.3
Techiman, Tamale, Ejura, Sunyani	6	28.6
Sunyani, Mampong, Tema, Kumasi	7	33.3
Elimina, Mankasim, Konongo	3	14.3
Total	***21***	***100***

Source: *Prepared from field survey data, furnished by aggregators, March 2016.*

Features of Groundnut Markets in Ghana

a) Near-end markets (Tamale and Bolgatanga)

In Tamale, the near-end market is dominated by a few aggregators linked to large haulage truck companies, which serve other end market aggregators and decision makers in Kumasi, Accra, and Takoradi. The near-end market is also dominated by small-scale aggregators (less than 2,500 MT/year). Medium size aggregators trade between 5,000–15,000 MT/year.

In Tamale and Bolgatanga, the NEMAs trade in varieties that are specific for each use (oil, peanut butter, snacks). The near-end market is dominated by groundnuts in stalls of medium quality (clean and non-sorted, non-graded groundnuts for markets in Kumasi and Accra). In the near-end market, improved quality control systems are needed to meet the high-quality requirements of the end market aggregators.

Aflatoxin-safe tests on groundnuts to map out aflatoxin-free areas/districts to support fixing aflatoxin-safe market premiums are not complete.

Market prices are fixed by market (supply and demand) forces. At present, only non-premium, non-tested aflatoxin-safe groundnut prices are prevalent in the near-end markets in Tamale and Bolgatanga (and probably in Wa).

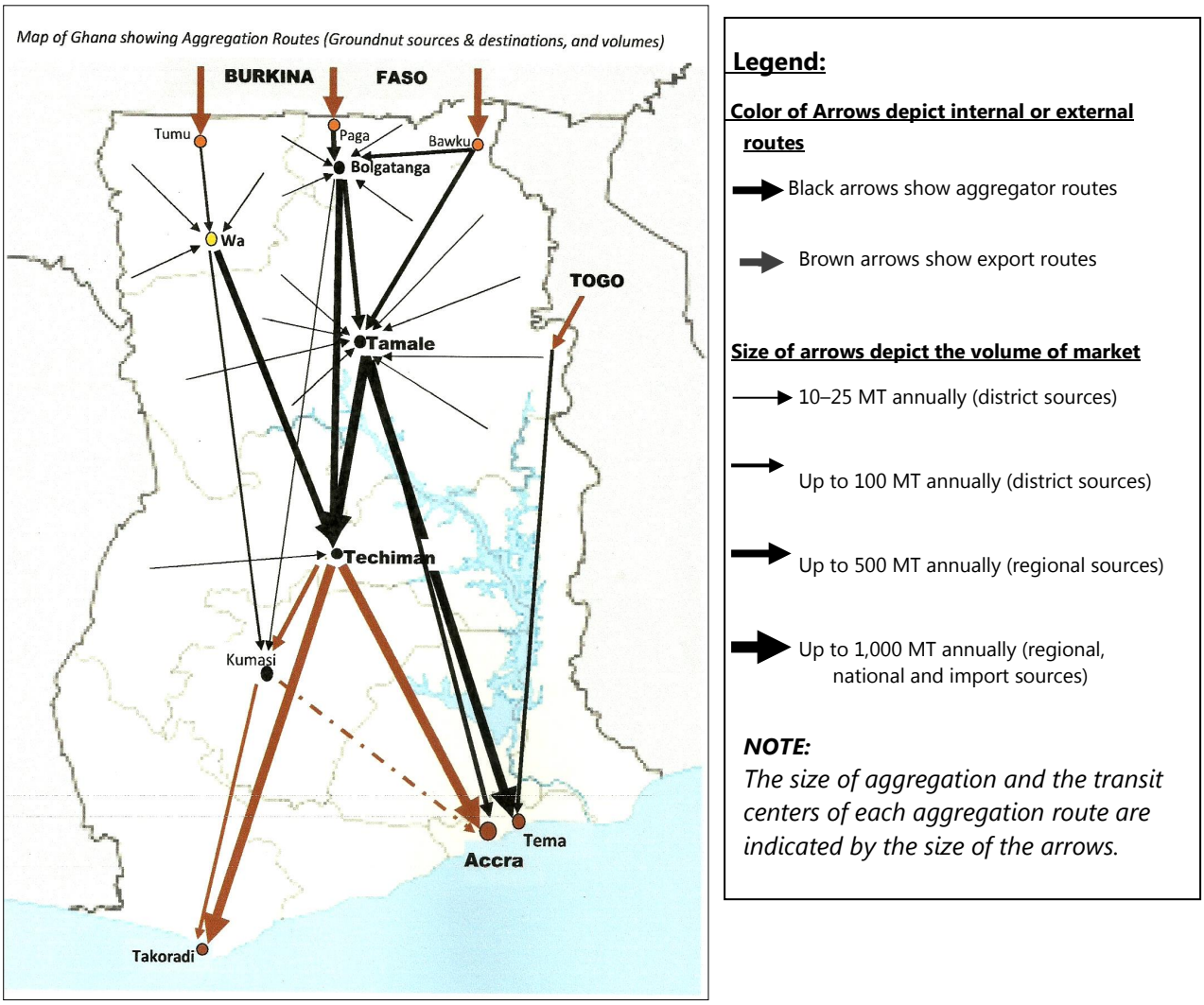
b) End Markets (Tamale, Techiman, and Kumasi)

The end markets in Tamale and Techiman are dominated by a few aggregators. As with the near-end markets, the aggregators work with large haulage truck companies who serve exporters and decision makers in Accra, Takoradi, and Abidjan. In Kumasi, the EMAs trade in volumes of more than 8,000 MT/year, unlike the NEMAs in Tamale and Bolgatanga who trade less than 5,000 MT/year (see Figure 1).

In the end markets in Tamale and Techiman, groundnuts are divided by size (small or large) and use (oil, peanut butter, snacks). The end market in Kumasi prefers groundnuts for producing oil, peanut butter, and snacks.

The EMAs in Tamale, Techiman, and Kumasi deal more with high quality groundnuts—fully graded, cleaned and sorted—for markets in Accra, Takoradi, and Abidjan, where established quality control systems are in place to meet export standards. Although the EMAs in Tamale, Techiman, and Kumasi ensure high quality, they do not test for aflatoxin.

Figure 1. Groundnut Aggregation Routes (sources, destinations, and volumes) in Ghana



Source: *Prepared from field survey information furnished by aggregators, May 2016*

Aflatoxin safety is not guaranteed and has been almost nonexistent since the Ghana Nuts Company stopped its peanut exports. Most often, supply and demand forces fix market prices. At present, only non-premium, non-tested aflatoxin-safe groundnut prices are available. Exporters and decision makers in Accra, Kumasi, and Takoradi fix premiums on high-quality premium, tested aflatoxin-safe groundnuts for EMAs in Tamale, Techiman, and Kumasi.

Attributes of aggregation, quality, and price characteristics

a) Near-end markets

See Table 6 for descriptions of the various attributes of aggregation, markets, quality, and price characteristics in the near-end markets.

In the near-end markets, *parameters* or *indications* were used to determine the values and scale of aggregation, markets, quality, and price characteristics. In Tables 6 and 7, the study used the terms *low*, *medium* and *high* to describe the marketed quality of groundnuts that attract different prices and premiums. The principal parameter used by the respondents for quality categorization was based on physical indicators: clean, sorted, and graded groundnuts.

The link between the aggregators' assessment of quality and market prices was based on the level of effort needed to obtain clean, sorted, and graded groundnuts. Although aggregators have very limited knowledge of aflatoxins and aflatoxin contamination, and they do not have aflatoxin testing equipment, they can use mold, debris, broken/cracked groundnuts, and other characteristics to determine the market price of groundnuts. Based on the aggregators' physical assessment of the degree of moldiness and other indications—debris, broken/cracked kernels, etc.—the study applied quality categories: low, medium, and high.

The quality categories helped respondents determine many parameters (market prices/premiums, preparedness/willingness to accept or pay, etc.). After the hurdles of aflatoxin contamination and quality determination were cleared, the data could be applied to the econometric analysis with a high degree of confidence (> 15 percent).

In the near-end markets (Tamale and Bolgatanga), the NEMAs explained the main issues of aggregation, quality, and price characteristics (see Table 9).

Table 9. Aggregation, Quality, and Price Characteristics in Near-End Markets

Parameter/Location	Tamale	Bolgatanga	Techiman
Aggregation market	Expansive near-end market	Restricted near-end market	Expansive near-end market
Scale (MT per aggregator)	Medium (≤500 MT/year)	Medium (≤ 200 MT/year)	Medium (≥ 800 MT/year)
Type of variety marketed	1. Sinkarzie 2. Chinese 3. Bugla	1. Chinese 2. Sinkarzie 3. Bugla	1. Sinkarzie 2. Chinese 3. Bugla
Scale of physical qualities of variety	Medium (cleaned and sorted non-graded groundnuts)	Medium (cleaned and sorted non-graded groundnuts)	High (cleaned and sorted partially graded groundnuts)
Low quality (aflatoxin-contaminated groundnuts)	Most prevalent (emerging quality control systems to meet requirements of end market aggregators)	Prevalent (established quality control systems to meet requirements of end market aggregators)	Less prevalent (established quality control systems to meet requirements of end market aggregators)
Medium quality (non-premium, non-tested aflatoxin-safe groundnuts)	Most prevalent (emerging quality control systems to meet requirements of end market aggregators)	Prevalent (established quality control systems to meet requirements of end market aggregators)	Less prevalent contamination (established quality control systems to meet requirements of end market aggregators)
High quality (market premium aflatoxin-safe groundnuts)	Non-existent. (Aflatoxin-safe tests on groundnuts are yet to be completed to map out aflatoxin-free areas/districts to support fixing an aflatoxin-safe market premium.)		
Market pricing systems	Market prices fixed by market forces (supply and demand). At present, only non-premium, non-tested aflatoxin-safe groundnut	Market prices fixed by market forces (supply and demand). At present, only non-premium, non-tested aflatoxin-safe groundnut prices are prevalent.	Market prices fixed by market forces (supply and demand). At present, only non-premium, non-tested aflatoxin-safe groundnut prices are fixed by end

Parameter/Location	Tamale	Bolgatanga	Techiman
	prices are prevalent.	Neighboring Burkina Faso influences the Bolgatanga market with groundnut exports through their agents in Paga, Bawku, Tumu, and Bolgatanga.	market aggregators and end market decision makers in Accra, Kumasi, and Takoradi.
Establishment of fair and sustainable market premiums	Non-existent. Except for the traditional crops there is no state established market pricing and premium system in Ghana for all other agricultural commodities. Some efforts, however, have been made to facilitate the regulations and guide the fixing of fair prices and premiums.[4] All is left to the dictates of the market system.		

Source: *Prepared from field survey information, furnished by aggregators, March 2016.*

b) End markets

See Table 10 for the summary of key issues explained by the EMAs in the end-markets (Tamale, Techiman, and Kumasi).

Table 10. Aggregation, Quality, and Price Characteristics in End Markets

Parameter	Tamale	Techiman	Kumasi
Aggregation market	Near-end market, dominated mainly by few aggregators linked to large haulage truck companies serving other end market aggregators and decision makers in Kumasi, Accra, and Takoradi.	End market, dominated mainly by few aggregators linked to large haulage truck companies serving exporters and decision makers in Accra, Takoradi, and Abidjan.	End market, dominated mainly by few aggregators linked to large haulage truck companies serving exporters at ports in Takoradi harbor, and to some extent in Tema harbor.
Scale (MT per aggregator)	Small scale (>2,500 MT/year)	Medium scale (≤ 5,000 MT/year)	Large scale (≥ 8,000 MT/year)
Type of variety marketed	Varieties marketed are categorized by use (for oil, peanut butter, snacks).	Varieties marketed are categorized by size (small or large) and use (oil, peanut butter, snacks).	For use in production of oil, peanut butter, snacks.
Scale of physical qualities of variety	Medium quality (cleaned and sorted, graded/non-graded groundnuts for markets in Kumasi and Accra)	High quality (cleaned and sorted, fully graded groundnuts for markets in Accra, Takoradi, and Abidjan)	High quality (cleaned and sorted, fully graded groundnuts for export markets)

[4] The accepted market price between 2013/2014 and 2015/2016 ranged between GHS 265 and GHS 335 for conventional market prices.

Parameter	Tamale	Techiman	Kumasi
Low quality (aflatoxin-contaminated groundnuts)	Non-existent. (Improved quality control systems are needed to meet requirements of end market aggregators.)	Non-existent. (Improved quality control systems are needed to meet requirements of end market aggregators.)	Non-existent. (Improved quality control systems are needed to meet requirements of end market aggregators.)
Medium quality (non-premium, non-tested aflatoxin-safe groundnuts)	Most prevalent (improved quality control systems to meet requirements of end market aggregators).	Prevalent (established quality control systems to meet requirements of exporters).	Highly reduced contamination (established quality control systems to meet requirements of exporters).
High quality (market premium assumed aflatoxin-safe groundnuts)	Aflatoxin-safe tests on groundnuts are yet to be completed to map out aflatoxin-free areas/districts to support fixing an aflatoxin-safe market premium.	Non-existent, but aflatoxin-safe tests on groundnuts are yet to be completed to map out aflatoxin-free areas/districts to support fixing an aflatoxin-safe market premium.	Somewhat non-existent since Ghana Nuts Company stopped its peanut exports. (Aflatoxin-safe tests on groundnuts are yet to be completed to map out aflatoxin-free areas/districts to support an aflatoxin-safe market premium.)
Market pricing systems	Market prices are fixed by market forces (supply and demand). At present, only non-premium, non-tested aflatoxin-safe groundnut prices are prevalent.	Most often, the market prices are fixed by market forces (supply and demand). At present, only non-premium, non-tested aflatoxin-safe groundnut prices are prevalent.	Market prices are fixed by market forces (supply and demand). At present, premium, tested aflatoxin-safe groundnut prices are fixed by exporters and decision makers in Accra, Kumasi, and Takoradi.
Establishment of fair and sustainable market premiums[5]	Fair and sustainable market premiums are currently non-existent. As of March 2016, except for the traditional crops (cocoa, coffee, etc.), there is no state established market pricing and premium system in Ghana for all other agricultural commodities.		

Source: *Prepared from field survey information, furnished by aggregators, March 2016.*

Scale and Monthly Volumes of Groundnuts Marketed

In terms of the scale[6] and monthly volumes of groundnuts marketed, the scale and volume were observed in the Bolgatanga market (Upper East Region) 150–200 MT, with ranges extending from a monthly minimum of Scale 1 (25–150 MT) to a monthly maximum of Scale 7 (500–800 MT).

[5] Although no widespread aflatoxin-safety testing has been completed, aggregators used the quality of groundnuts to determine premiums, particularly on groundnuts from Bolgatanga and Wa.

[6] The term *scale* is used differently by aggregators in the two markets to guide the volume or number of bags handled by each aggregator. The data received from aggregators (no. of maxi-bags) was converted into MTs.

In the Tamale market (Northern Region), the scale and monthly volume ranged from a minimum of Scale 1 (100–200 MT) to a maximum of Scale 9 (800–1,500 MT). See Table 11 for the details of the scale and monthly volumes in the two markets.

Table 11. Scale and Monthly Volumes of Groundnuts Marketed (2014/2015)

Scale and Monthly Volumes of Groundnuts Marketed from Upper East Region (2014/2015)		
	No. of Aggregators	**Percentage (%)**
Scale 1 (15–25 MT)	3	14.3
Scale 2 (25–30 MT)	1	4.8
Scale 3 (25–35 MT)	1	4.8
Scale 4 (100–150 MT)	4	19.0
Scale 5 (150–200 MT)	5	23.8
Scale 6 (150–300 MT)	1	4.8
Scale 6 (300–500 MT)	4	19.0
Scale 7 (500–800 MT)	2	9.5
Total	***21***	***100.0***

Scale and Monthly Volumes of Groundnuts Marketed from Northern Region (2014/2015)		
	No. of Aggregators	**Percentage (%)**
Scale 1 (100–200 MT)	4	19.0
Scale 2 (200–350 MT)	2	9.5
Scale 3 (300–3500 MT)	4	19.0
Scale 4 (350–450 MT)	1	4.8
Scale 5 (400–500 MT)	1	4.8
Scale 6 (450–500 MT)	4	19.0
Scale 7(500–700 MT)	1	4.8
Scale 8 (500–800 MT)	2	9.5
Scale 9 (800–1500 MT)	2	9.5
Total	***21***	***100.0***

Source: *Prepared from field survey data, furnished by aggregators, March 2016.*

See Table 12 for an estimated total annual quantity by aggregators in 2014/2015, based on maximum scales applied in the two markets (Tamale and Bolgatanga).

Table 12. Scale and Annual Volumes of Groundnuts Marketed (2014/2015)

Scale and Monthly Volumes of Groundnuts Marketed from Upper East Region (2014/2015)		
	No. of Aggregators	**Estimated Maximum Quantity (MT)**
Scale 1 (15–25 MT)	3	900
Scale 2 (25–30 MT)	1	360
Scale 3 (25–35 MT)	1	420
Scale 4 (100–150 MT)	4	7,200
Scale 5 (150–200 MT)	5	12,000
Scale 6 (150–300 MT)	1	3,600
Scale 6 (300–500 MT)	3	24,000
Scale 7 (500–800 MT)	2	19,200
Total	***20***	**67,680**

Scale and Monthly Volumes of Groundnuts Marketed from Northern Region (2014/2015)		
	No. of Aggregators	**Estimated Maximum Quantity (MT)**
Scale 1 (100–200 MT)	4	9,600
Scale 2 (200–350 MT)	2	8,400
Scale 3 (300–400 MT)	4	19,200
Scale 4 (350–500 MT)	1	6,000
Scale 5 (400–550 MT)	1	6,600
Scale 6 (450–500 MT)	4	24,000
Scale 7 (500–700 MT)	1	8,400
Scale 8 (500–800 MT)	2	19,200
Scale 9 (800–1500 MT)	2	36,000
Total	***21***	**137,400**

Source: *Prepared from field survey data, furnished by aggregators, March 2016*

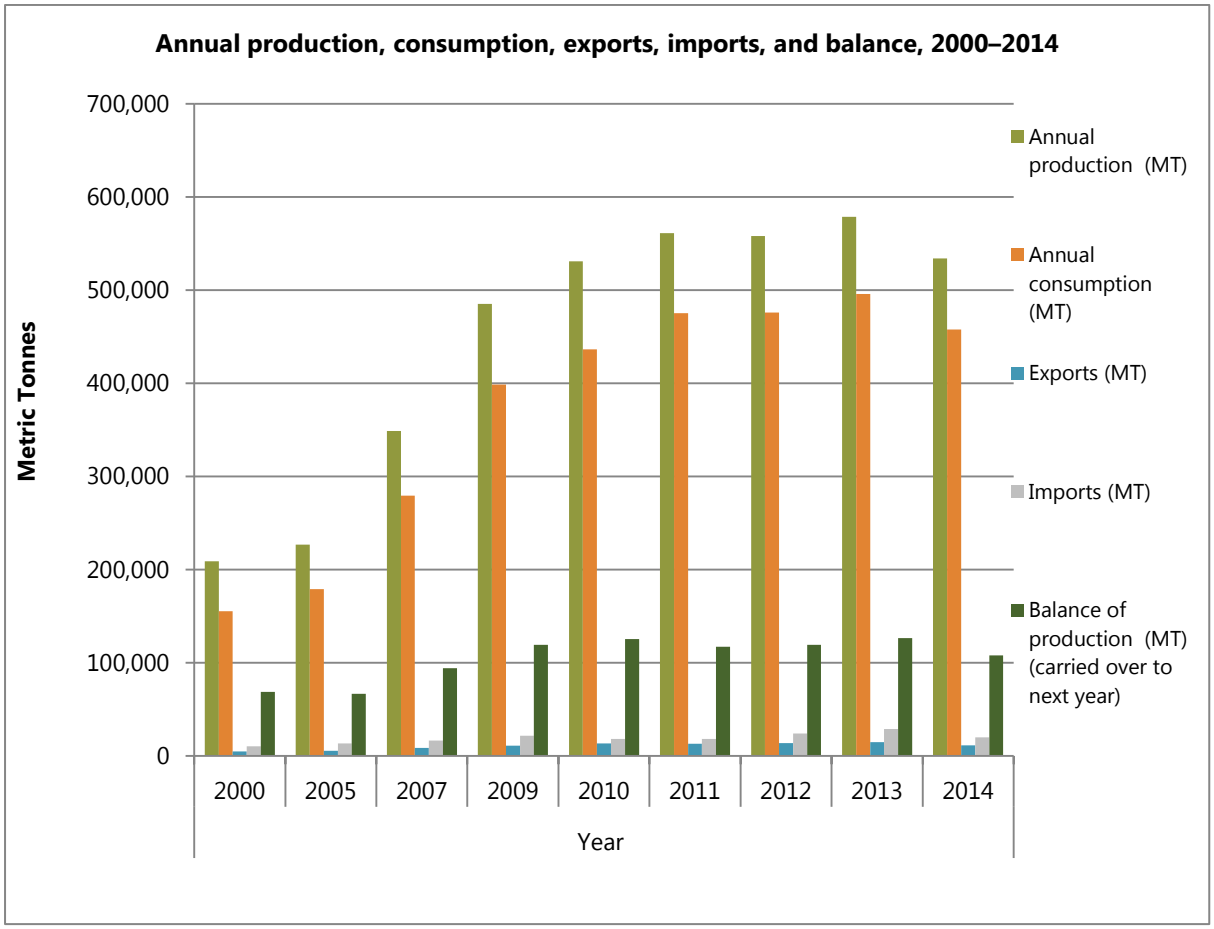
In the 2014/2015 market year, aggregators marketed a total of 205,080 MT[7] in Tamale and Bolgatanga. In Techiman, aggregators were reluctant to provide data on quantities marketed because they feared competition, among other factors. Because Wa (Upper West Region) was not part of the study, data on marketed quantities could not be collected.

Domestic groundnut consumption in 2014 was 457,593 MT (see Table 12 and Figure 2). During the 2014/2015 market year, aggregators in Tamale and Bolgatanga marketed a total of 205,080 MT.[8]

[7] This figure can be used as a guide to determine more accurate market projections.

[8] The study estimated that, based on the assumption that the total quantities marketed in Techiman and Wa might be more or less equal to the 205,080 MT marketed in Tamale and Bolgatanga, the total estimated annual marketed quantities would be 410,160 MT. This figure compares closely to annual consumption data in 2014 from secondary sources (see Table 1).

Figure 2. Annual Production, Consumption, Exports, Imports, and Balance/Surplus Production, 2000–2014



Source: *Prepared from secondary sources (MOFA, FAO, and other studies) from 2000 to 2014. March 2016*

Location of Aggregators in Markets and Scale of Aggregation

Tamale market has the largest number of aggregators.

The study focused on NEMAs and EMAs because the they have power to influence market prices and premiums. Small-scale aggregators (traders, processors, vendors, and price speculators located mostly in district markets) were assumed to be *price takers*, lacking power to set prices or premiums; they were not included in the study.

In terms of the scale of aggregation, medium-scale aggregators (about 62 percent) were more common than large-scale aggregators (about 38 percent), as shown in Table 13.

Table 13. Location of Aggregators and Their Scale

Location of Aggregators in Markets		
Market	***No. of Aggregators***	***Percentage (%)***
Tamale	8	38.1
Bolga	7	33.3
Techiman	6	28.6
Total	***21***	***100.0***

Scale of Aggregation		
Scale	***No. of Aggregators***	***Percentage (%)***
Medium	13	61.9
Large	8	38.1
Total	***21***	***100.0***

Source: *Prepared from field survey data, furnished by aggregators, March 2016.*

See Table 14 for the details of their activities (sources of market information, level of knowledge on aflatoxins, and knowledge of setting market prices and market premiums).

Table 14. Source of Market Information, Knowledge of Aflatoxins, and Market Premiums

Parameter	Market	Tamale		Bolgatanga		Techiman		Kumasi
Market type	**Description**	**Near-end markets**	**End markets**	**Near-end markets**	**End markets**	**Near-end markets**	**End markets**	**End markets**
Sources of market price information	District	50.2%	43.2%	57.6%	45.5%	48.4%	38.1%	40.1%
	Regional	34.1%	32.7%	30.3%	30.3%	32.2%	32.3%	26.2%
	National	15.7%	24.1%	11.1%	24.2%	19.4%	29.6%	33.7%
Knowledge of aflatoxins and mycotoxins	None	78.3%	67.3%	71.3%	61.5%	61.3%	41.3%	47.1%
	Little	12.6%	20.6%	20.5%	20.3%	20.4%	30.4%	24.4%
	Much	9.1%	12.1%	8.2%	18.2%	18.3%	28.3%	28.5%
Knowledge of price setting	None	78.3%	72.4%	68.6%	58.40%	48.5%	47.5%	34.0%
	Little	14.5%	17.0%	24.2%	29.10%	24.3%	31.3%	33.8%
	Much	7.2%	10.6%	7.5%	12.50%	27.2%	21.2%	32.2%
Knowledge of market premiums	None	83.1%	62.2%	58.4%	48.4%	42.4%	52.5%	32.4%
	Little	12.7%	23.6%	29.1%	27.9%	23.3%	25.3%	34.3%
	Much	4.2%	14.2%	12.5%	23.7%	34.3%	22.2%	33.3%

Source: *Prepared from field survey data, furnished by aggregators, March 2016.*

The district markets are the most reliable sources of market information in the four locations (Tamale, Bolgatanga, Techiman, and Kumasi). Apart from the Kumasi market, none of the aggregators in all the other market locations (near-end markets and end markets) had knowledge of aflatoxins/mycotoxins, market premiums, or setting market prices.

Quality Control and Improvement Practices

Aggregators in Tamale were the most sensitive to the poor quality of groundnuts sold to them from the districts. The aggregators indicated that they employed elderly women in the Tamale Aboabo market, who use hand-held sieves to improve the quality of kernels before the groundnuts are marketed. The aggregators paid the extra labor costs for quality improvement—a cost which was later transferred to buyers and consumers.

The situation in Bolgatanga market was quite different. Groundnuts in the Upper East Region and the drier districts of Northern Region (West and East Mamprusi districts and Bunkpurugu Yunyoo district) are always hand-shelled, pre-cleaned, pre-sorted, and sometimes graded before farmers (usually women) sell them.

Groundnuts from Putinga and Leo markets in Burkina Faso are higher quality because they are already cleaned, sorted, and graded. Therefore, little or no additional costs are incurred to clean, sort, and grade the kernels before they are sold.

Although the Upper West Region is not part of the SPRING operational zone, the groundnuts traded in the Wa market are of higher quality and attract higher market prices.

In Tamale market, each maxi-bag of 80 kg of groundnuts cost GHS 10 for cleaning, sorting, and grading. For groundnut marketing to large aggregators and companies, the 80 kg maxi-bags are usually converted into 100 kg bags. It costs GHS 12 per 100 kg to clean, sort, and grade the groundnuts.

When queried, all 21 aggregators reported they did not know how to test for aflatoxin safety levels. They explained that when if buying companies provided aflatoxin testing equipment and trained them, they would be able to follow the instructions and also enjoy premiums on the market produce.

Aggregators indicated that groundnut kernels are infected in transit through leaks in the under-tarpaulin covers of the haulage trucks. To prevent re-infection by molds and mycotoxins, they recommended that transporters and their truck drivers be trained to look for leaks and use leak-proof tarpaulins.

Market Prices and Pricing Systems

a) Market price types (quality influences on premiums and discounts)

Aggregators indicated that market prices are influenced by the quality of the groundnuts they trade. Additional costs incurred for cleaning, sorting, and grading raise the price, and the extra cost is transferred to the consumer. The study identified three quality grades, each of which attracts a different price category:

- low quality, conventional market prices, mostly paid by local market traders, processors, vendors
- medium quality, non-premium market price, mostly paid by small and medium aggregators, price speculators
- high quality market premium-based prices, mostly paid by EMAs, big buyers, brokers, exporters.

Aggregators explained that it is not just the quality of the groundnuts, but also the preferences of the customers and buyers that affect prevailing prices. When big buyers focus on high oil-content groundnuts (such as *Chinese* or *Manipinta* varieties) in a given a month, the prevailing prices shift toward these varieties.

The market prices of other groundnut varieties are also slightly affected, either increasing or decreasing depending on the other prevailing market prices.

Table 15 shows the different prices paid for the three grades of groundnuts. During peak price season in July–September 2015 (the 2014/2015 marketing year), aggregators paid an average GHS 360 per maxi-bag for low quality (conventional groundnuts). High quality (but non-premium) groundnuts [9] were GHS 400 per maxi-bag, and high quality premium[10] groundnuts were GHS 480 per maxi-bag.

Table 15. Market Prices According to Quality and Market Premium, 2014/2015 Market Year

Low Quality Conventional Groundnuts		
Price per maxi-bag (GHS)	**No. of Aggregators**	**Percent-age (%)**
360	16	76.2
370	5	23.8
Total	***21***	***100.0***

Medium/High Quality Non-Premium Groundnuts		
Price per maxi-bag (GHS)	**No. of Aggregators**	**Percent-age (%)**
400	15	71.4
410	6	28.6
Total	***21***	***100.0***

High Quality Market Premium Groundnuts		
Price per maxi-bag (GHS)	**No. of Aggregators**	**Percent-age (%)**
470	2	9.6
480	17	81.0
495	2	9.5
Total	***21***	***100.0***

b) Seasonality of price shifts (harvest season and storage season)

Aggregators noted that seasonal changes in groundnut prices were in two broad ranges: harvest season price changes and storage season price changes. Table 17 and Figure 2 display data on average market prices and seasonal changes to show the most common prices during each of the four seasons (two harvest seasons and two storage seasons) during the 2014/2015 market year cycle.

c) Harvesting season price difference between buying prices and selling prices

The seasonal buying price change between harvest season 1 and harvest season 2 was GHS 15.00 in 2013/2014 and GHS 20.00 in 2014/2015 and 2015/2016. The seasonal selling price change between harvest season 1 and harvest season 2 was GHS 10.00 in 2013/2014 and GHS 20.00 in 2014/2015, but it was GHS 30.00 in 2015/2016. See Table 17.

[9] Local traders, processors, and vendors primarily buy non-premium groundnuts; they have a strong preference for varietal features, but are not as concerned with quality (even if the groundnut kernels are of high quality). Non-premium groundnuts are seen more in near-end markets (e.g., Bolgatanga, Wa, and Tamale).

[10] Premium groundnuts are high-quality kernels that have been cleaned, sorted, and graded to obtain export-grade groundnut kernels.

Table 16. Average Buying and Selling Prices and Profits (Harvest Quarter 1) from 2013/2014 to 2015/2016.

Buying Prices *(GHS per 100 kg max. bag)*	**2013/2014**[11] **(GHS)**	**2014/2015 (GHS)**	**2015/2016**[12] **(GHS)**
Harvest season 1 (October–December)	255.00	265.00	300.00
Harvest season 2 (January–March)	270.00	285.00	320.00
Seasonal change in buying prices *(between harvest season 1 and season 2)*	15.00	20.00	20.00
Storage season 1 (April–June)	275.00	295.00	360.00[13]
Storage season 2 (July–September)	295.00	320.00	380.00[14]
Seasonal change in buying prices *(between storage season 1 and season 2)*	20.00	25.00	20.00
Annual change in buying prices (October–September)	40.00	55.00	80.00
Selling prices *(GHS per 100 kg max. bag)*	2013/2014	2014/2015	2015/2016
Harvest season 1 (October–December)	270.00	280.00	330.00
Harvest season 2 (January–March)	280.00	300.00	340.00
Seasonal change in selling prices *(between harvest season 1 and season 2*	10.00	20.00	30.00
Storage Season 1 (April–June)	280.00	280.00	380.00[15]
Storage Season 2 (July–September)	325.00	360.00	405.00[16]

[11] Data on the 2013/2014 was not reliable. Much of the data collected was by data recall (by memory), therefore, it was not included in the analysis on seasonality of price shifts.

[12] For 2015/2016 market year, price data collected during harvest seasons 1 and 2 (between October 2015 and March 2016) were reliable, and aggregators used the prices to predict prices from April to September 2016.

[13] The buying prices during storage season 1 (April–June) are conservative prices, because the aggregators did not want to be caught unawares should prices not rise as predicted or expected.

[14] The buying prices during storage season 2 (July–September) are conservative prices, because the aggregators did not want to be caught unawares should prices not rise as predicted or expected.

[15] The selling prices during storage season 1 (April–June) are conservative prices, because the aggregators did not want to be caught unawares should prices not rise as predicted or expected.

[16] The selling prices during storage season 1 (April–June) are conservative prices, because the aggregators did not want to be caught unawares should prices not rise as predicted or expected.

Buying Prices *(GHS per 100 kg max. bag)*	**2013/2014**[11] **(GHS)**	**2014/2015 (GHS)**	**2015/2016**[12] **(GHS)**
Seasonal change in selling prices *(between storage season 1 and season 2)*	15.00	20.00	25.00
Annual change in buying prices (October–September)	55.00	80.00	75.00
Annual change between buying prices and selling prices (October–September)	**15.00**	**25.00**	**15.00**

Source: *Prepared from field survey data, furnished by aggregators, March 2016.*

d) Storage season price difference between buying prices and selling prices

Table 12 shows that the seasonal buying price shift/change between harvest seasons 1 and 2 was GHS 20.00 in 2013/2014, and GHS 25.00 in 2014/2015, while it was GHS 20.00 in the 2015/2016 market years. The seasonal selling price change between storage season 1 and harvest season 2 was GHS 15.00 in 2013/2014, and GHS 20.00 in 2014/2015, while it was GHS 25.00 in the 2015/2016 market years.

The annual shifts/difference between the seasonal buying and selling prices during the harvest seasons were GHS 15.00 in 2013/2014, and GHS 25.00 in 2014/2015, while it was GHS 15.00 in the 2015/2016 market year. Thus, the inter-year seasonal price shift/difference between 2013/2014 and 2014/2015 market years was GHS 20.00 (60 percent). Between the 2014/2015 and 2015/2016 market years, the inter-year seasonal price shift/difference was GHS 20.00 (60 percent). Thus, there was no net inter-year seasonal price shift. This price stability corroborates reports that Ghana's groundnut marketing and consumption is largely domestic. Groundnut exports from Ghana are negligible (DFID 2014; Awuah et al. 2006).

Table 18 to Table 31 in Annex 4 show detailed data on seasonal (quarterly) prices. Gradual changes/shifts between prices in the first two harvest seasons (October–December and January–March) were observed, but there is a sharp rise in prices between and within the two storage seasons (April–June and July–September) in each of the three years. Inter-year changes/shifts in prices rose gradually between year 1 (2013/14 marketing year) and year 2 (2014/15 marketing year). However, there were sharp price changes/shifts between year 2 (2014/15 marketing year) and year 3 (2015/16 marketing year).

Aggregators said that since December 2014, the export market for groundnuts has not grown because of increased domestic groundnut oil processing. There were also fewer groundnut imports from Burkina Faso and exports increased, particularly to Ivory Coast, Liberia, and the European Union.

See Annex 5 for detailed information on groundnut markets, market sources, destinations, yearly market prices, and premiums (from 2013/2014 to 2015/2016).

Price sensitivity effects on willingness to accept or pay market prices and premiums

The price sensitivity analysis of market prices and premiums showed strong positive correlations between supply and demand, and between market prices in the four markets, based on selfish profit-optimization.[17] The market supply price of groundnuts (at harvest) was an average of GHS 245 in 2013/14, GHS 265 in 2014/15, and GHS 305 in 2015/16. Market demand price (at harvest) was an average of GHS 265 in 2013/14, GHS 285 in 2014/15, and GHS 335 in 2015/16.

Price sensitivity effects on preparedness and willingness to accept or pay market premiums showed similar behavior at both turning points (when groundnut market prices rapidly increase due to scarcity) and yield points (during harvesting seasons when market prices are low because of surplus supply).[18] Price sensitivity effects were observed in the four markets.

The study identified the tipping points in market prices. The tipping point is described as "the price at which an aggregator definitively acts to either to sell or buy" (performance of a sale or purchase). Tipping points provided the study some useful insights into prevailing sensitivities to guide the fixing of fair and sustainable market prices and premiums.

At the market price turning point, when price shifts are more than 50 percent (i.e., at the end of the harvest season in March and storage season in September), aggregators respond by raising or lowering market prices to make up for losses over the season.[19] Aggregators explained that shifts in prices are always caused by external forces (e.g., lean/bumper years, buyers invasion/withdrawal, induced price hikes/troughs, and high imports from Burkina Faso). Market premiums were influenced only by offers from brokers and large companies in the end markets and aggregators respond differently to premiums offered for quality and volume supplied.

When market prices do not rise as expected, EMAs create artificial shortages to restrict supply, which drives prices up. Near-end market aggregators, on the other hand, do not lower prices for any reason.

When market prices rise unexpectedly, the EMAs increase the supply by releasing larger quantities of stocks into their markets. This practice may seem counterintuitive, but the EMAs said sometimes they have interests other than profits. For instance, when prices rose due to poor harvest seasons, some NEMAs would mix moldy, insect-infested produce with clean high quality grain, according to one EMA interviewed. This practice ultimately lowered prices.

One key concern of EMAs is how to control and maintain supply and demand flows, especially when their markets are affected by external forces (buyers, exporters, etc.). By June and July, speculators release their stored groundnut stocks into the near-end markets (Bolga, Wa, and large district markets), either to profit from rising groundnut prices, or for other reasons. The ensuing glut creates chaos in the EMA markets, until sometime in August or September when the planting season ends.

The market price yield point—the end of the harvest and storage season (end of March and September, respectively)—is when aggregators decide to accept or refuse prevailing market prices that are lower than 50

[17] Selfish profit optimization is a standard econometric term that is different from other profit optimization of price sensitivity analysis.

[18] Market price turning and tipping points are described in detail in Annex 2.

[19] When market prices do not rise as expected, the EMAs create artificial shortages to restrict supply and drive prices up. This is a normal, expected marketing practice.

percent of the price shifts over the season. To increase market prices, the NEMAs explained that the EMAs create artificial shortages.[20] The yield point is influenced by trends in price shifts (between GHS 200 and GHS 400 per ton for harvest and storage seasons, respectively). The aggregators explained that the price shifts are, in turn, influenced by turning points, including protracted low turning points or large hikes in the prevailing market prices.

The observed econometric tipping points in market prices, and the prevailing sensitivities, showed that NEMAs had more control over fixing fair and sustainable market prices and premiums than EMAs and EMDMs.

Formal structures and organizations of aggregators

No formally organized aggregators were found in the near-end markets; i.e., enterprises are not yet registered with the Department of Cooperatives and/or the Registrar of Companies at the Registrar General's Department.

1) All of the 12 NEMAs in Tamale, Bolgatanga, and Techiman are loosely organized and are only interested in dealing with supply contractors for foodstuffs, including groundnuts.

2) The seven EMAs have, to varying degrees, some management skills and capacities in recordkeeping and data management. Four EMAs lamented the difficulty of combining their selling (marketing) activities with recordkeeping. They are quite tired by the end of the day, when they do their data entry and recordkeeping.

3) There are no strong or established EMAs who can influence the groundnut market premium because, they explained, they have limited warehouses for large storage, and limited working capital to provide inventory storage for smaller aggregators, processors, and vendors.

4) Avnash and PPB are the only two aggregators in the four end markets that are properly organized and formally registered. They are, however, only emerging firms, and have not started working in Ghana's groundnut markets. Currently, they have little or no influence on the groundnut market premiums.

5) Ghana Nuts Company and SAVBAN Company no longer work in the groundnut market because of import restrictions due to aflatoxin safety issues on groundnuts. However, the Ghana Nuts Company explained that the two firms would resume operations when proper training is available for NEMAs and EMAs to promote and sustain widespread improved quality control and aflatoxin safety.

Market data available for determination of prices, market premiums

Very limited market data[21] is available from NEMAs to determine the prices and, possibly, the market premiums by EMDMs or large brokers, if bargaining is involved. The aggregators explained that they face serious challenges to recordkeeping and data management because of the high pressure in their business, coupled with limited numeracy and literacy. Moreover, they cannot afford to employ accounting staff for bookkeeping and data storage.

Aggregators PWTAP

Out of the 12 NEMAs studied, 7 indicated they are willing to accept market prices and premiums by potential end market decision makers (e.g., Avnash and PPB). Aggregators stated they are prepared and willing to abide by the prevailing market prices when the market premiums are properly established. Five aggregators,

[20] The EMAs are able to drive prices by creating artificial shortages and control the quantities of groundnuts sold in their markets, particularly when they expect large buyers from Accra, Tema, or Takoradi.

[21] Properly retrievable data (stored on tally sheets, record books, and electronic forms)

however, stated they would only accept market prices and premiums that are established by large national bodies (e.g., Ministry of Food and Agriculture, Ministry of Trade and Industries) for fear of unfair market prices and premiums that may be offered by exporters.

Market brokers with capacities to influence and/or stabilize groundnut market premiums

Two potential groundnut market power brokers, Avnash and PPB, have not started purchasing large volumes of groundnuts. Avnash indicated that the company's vegetable oil mill can process more than 200,000 MT annually. PPB estimated that only about 250 MT of aflatoxin-free groundnuts were absorbed from Ghana's groundnut market annually. Within the next three years, when the accepted aflatoxin-safety level is attained, the company expects their groundnuts to be sourced solely from Ghana. PPB was reluctant to release information on quantities of groundnuts currently used from external sources and was conservative on its projections on quantities of aflatoxin-safe groundnuts that it will purchase.

Correlation between price sensitivity, shifts in supply, demand, and market price

Aggregators' sensitivity to changes/shifts in groundnut market prices and premiums showed a strong econometric correlation between price shifts in supply, demand, inventory (stocks), and market price, based on the econometric principle of selfish profit-optimization.

Price Sensitivity Analysis of Market Premiums on Groundnut Value Chain

The study used price sensitivity analysis (PSA) to determine the sensitivity relationships between supply, demand, inventory, and the market price of groundnuts within an analytical framework based on the econometric principle of selfish profit-optimization. The analysis identified a sharp turning point in market prices when commodity availability changes. As a rigorous agent-based model, the turning point is generally manifested in a sharply increasing anti-correlation between price and commodity availability, based on phase transitions (as applied in statistical mechanics).

Price sensitivity effects on preparedness and willingness to accept or pay market premiums

Real market prices exhibit similar behavior at both turning points (where groundnut market prices rapidly increase during periods of increasing scarcity), and yield points (during harvesting seasons when market prices are low due to surplus supply). The study determined the observed tipping points in market prices, and provided useful insights into prevailing sensitivities to guide the determination of fair market prices and premiums.

The behavior of aggregators was consistent with the prospect theory, which states that people make decisions based on the potential value of losses and gains rather than the final outcome. The model captures real-life choices, rather than optimal decisions, as normative models do (Kahneman and Tversky 1979; Tversky and Kahneman 1992). This study applied an adapted version of the prospect theory to assess and determine the probability of decision outcomes for aggregators' preparedness and willingness to pay or accept market premiums in the groundnut value chain.

Individual aggregators have different levels of WTAP market premiums when they consider the prevailing levels of probability in their respective market locations (i.e., Tamale, Bolgatanga, Techiman, and Kumasi). Their

risk attitudes, consequently, have very different implications for their WTAP market premiums, based on their understanding and sensitivities to the changes and shifts in prices over a given period.

In the absence of prevailing or established market premiums in the groundnut value chain in Ghana, the study assumed that the difference between the lower and upper limits of prevailing market prices could safely be used as a market premium. Based on that assumption, the study examined the sensitivities of aggregators to changes and shifts in prices and premiums to determine the WTA and WTP of aggregators.

Shift ratio of prices and premiums in near-end and end markets

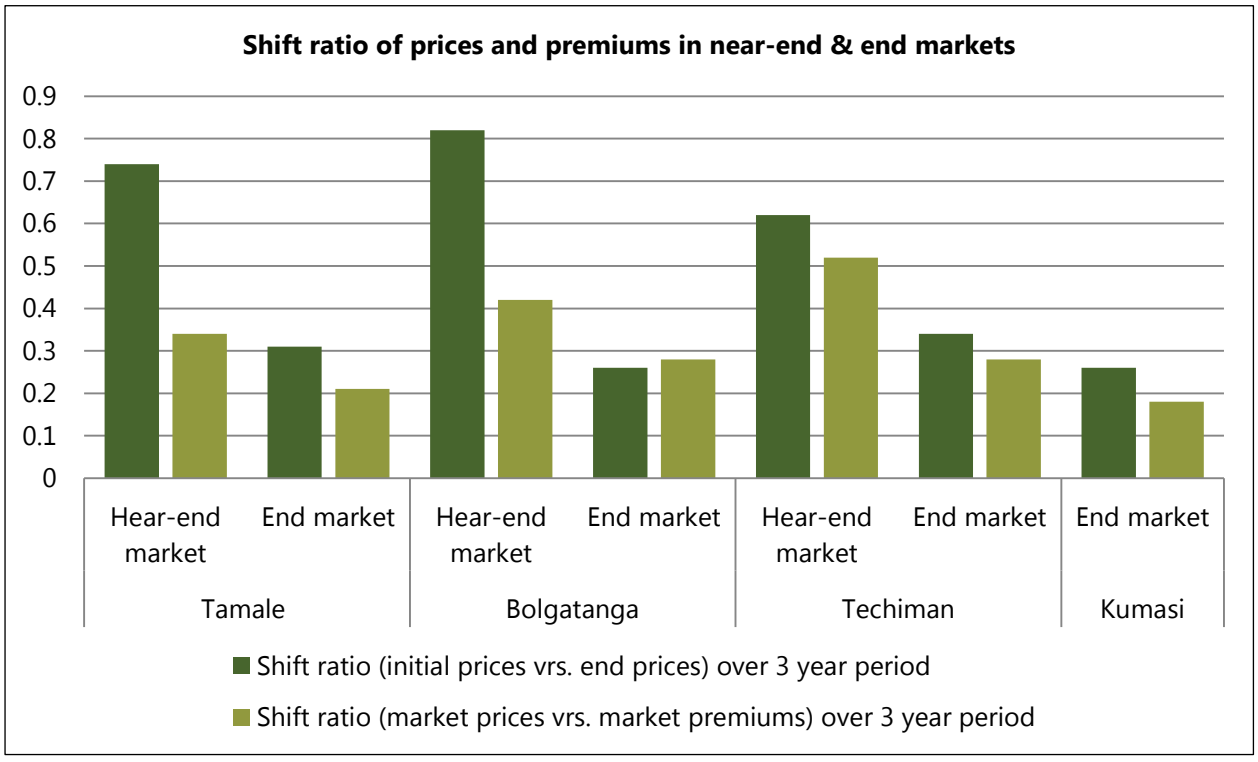
The econometric term *price shift ratio* means *percentage price change*. It is used as a proportion/ratio instead of a percentage (e.g., 50 percent generated by the SPSS program is converted and the SAS program uses it as 0.5).

Aggregators in all the three near-end markets (Tamale, Bolgatanga, and Techiman) were sensitive to price and premium shifts. Specifically, they were sensitive to a price shift of more than 0.5 or a 50 percent, and are influenced by their market's dynamics.

End market aggregators (in Tamale, Techiman, and Kumasi) were less influenced by trends/changes and shifts (i.e., with sensitivity less than 0.5 or a 50 percent price shift). Therefore, they have more control over prices and premiums and can influence the dynamics of market price and market premiums.

Except for the Techiman market, the shift ratio between market prices and market premiums over the three-year period is lower than 0.5 (less than 50 percent in shifts between prices and premiums). The low ratio connotes little influence of shifts and changes in prices and premiums on the dynamics between the WTA and WTP demonstrated by aggregators in near-end markets located in Tamale and Bolgatanga, as well as the end markets in Tamale, Bolgatanga, and Kumasi. Figure 3 illustrates the shift ratio of prices and premiums in the near-end and end markets (2013/14 to 2015/16).

Figure 3. Shift Ratio of Prices and Premiums in Near-End and End Markets, 2013/14 to 2015/16

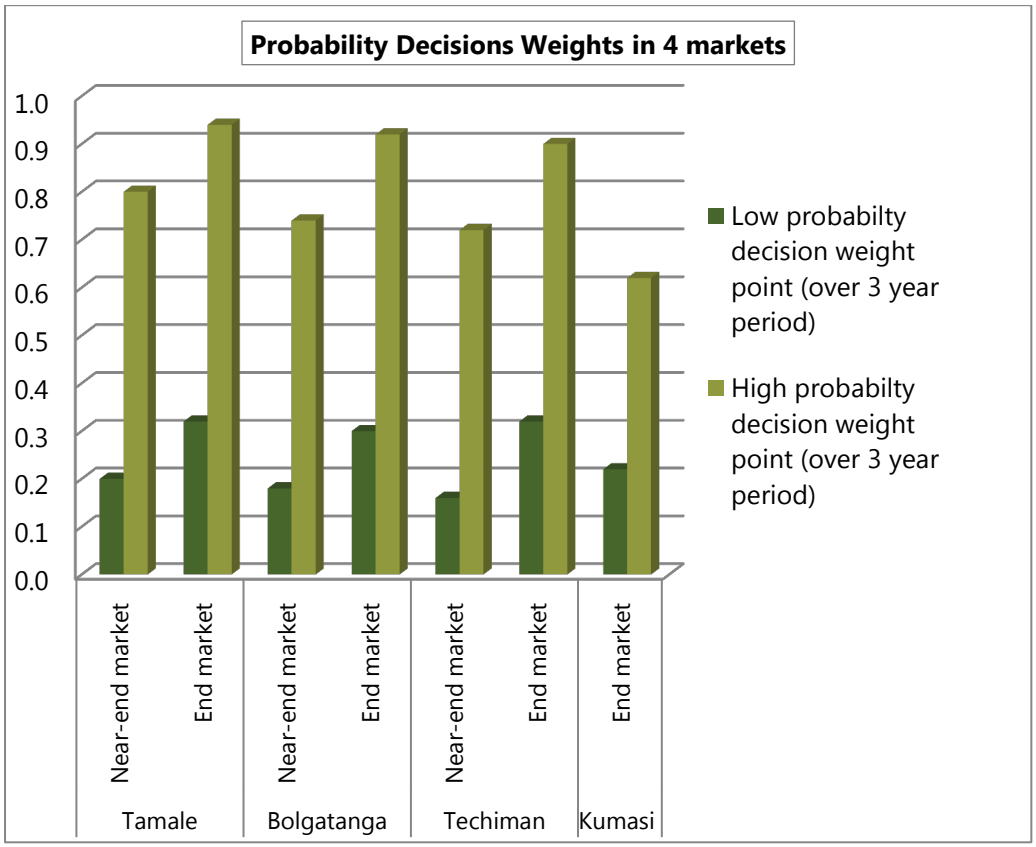


Source: Produced by SAS program from outputs of SPSS program from field survey data, March 2016.

Probability decision weights that affect sensitivity of market prices and premiums

Aggregators' sensitivities were strongly influenced by high probability weights (i.e., they responded to the likelihood of obtaining more secure prices and premiums). Figure 4 illustrates the two sets of probability decisions weights (high and low probability) in the four markets to demonstrate how strongly or weakly the probability decisions affect the aggregators' market prices.

Figure 4. Probability Decisions Weights in Four Markets from 2013/14 to 2015/16



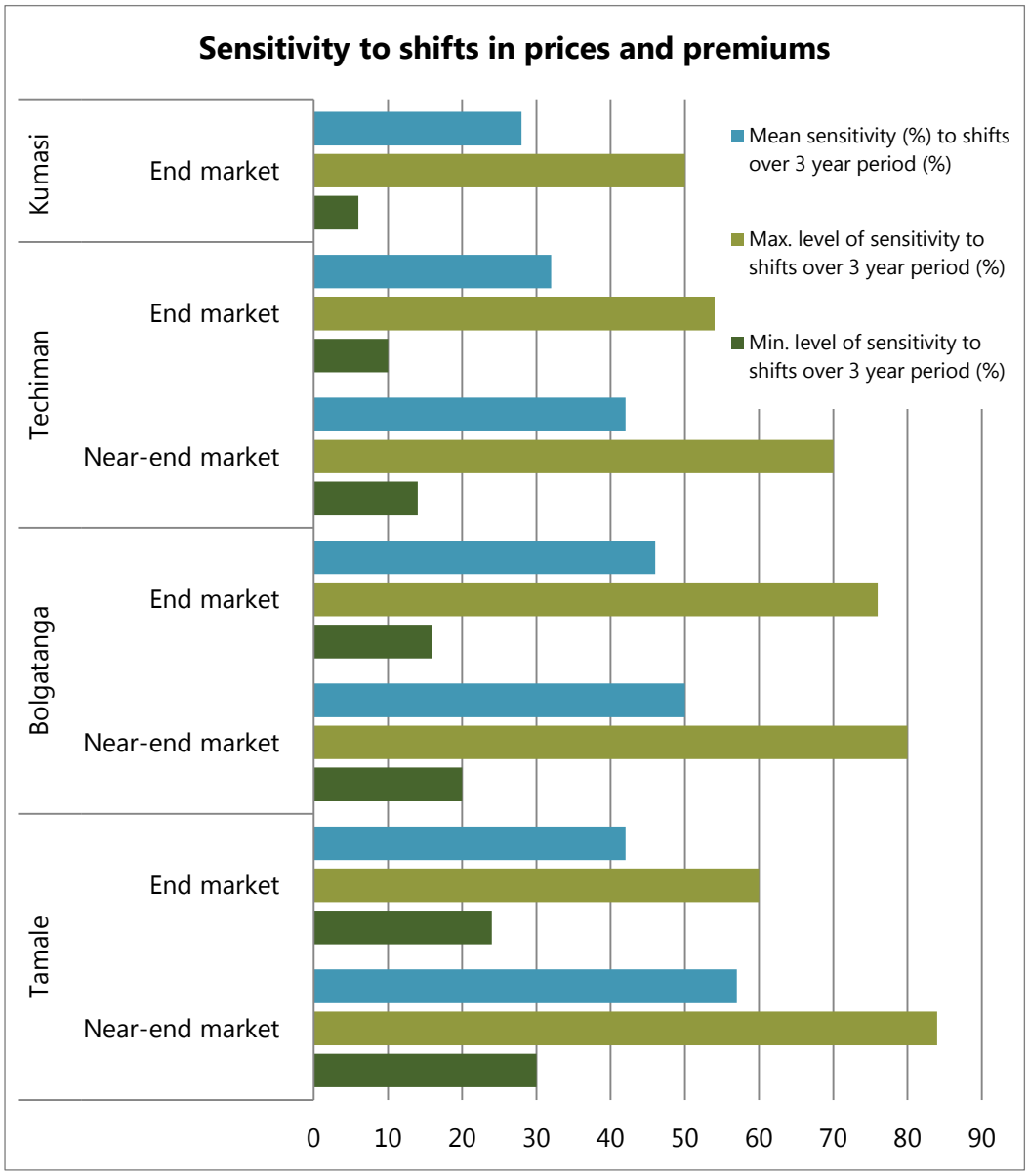
Source: Produced by SAS program from outputs of SPSS program from field survey data. March 2016.

Sensitivity to shifts in prices and premiums affecting willingness to accept or pay

Near-end markets are strongly influenced by shifts in prices and premiums, and therefore affecting the willingness of aggregators in near-end market than to aggregators in end markets to either accept or reject the market prices on hand, or to pay or discount prices. Additionally, there was a decrease (falling trend) at base (minimum) sensitivities to shifts in prices and premiums that influence the propensity of preparedness and willingness of aggregators in both near-end and end markets to either accept or reject prices and premiums.

Apart from the near-end market in Tamale, where aggregators are more sensitive to shifts in prices and premiums (more than 50 percent sensitivity), the aggregators in Bolgatanga (a near-end market) are not influenced as much by shifts. Figure 5 illustrates the extent of sensitivity of aggregators in the four markets and how they respond to shifts in prices and premiums that affect the willingness to accept or pay, with details of trends between four market locations from 2013/14 to 2015/16 groundnut marketing years.

Figure 5. Sensitivity to Shifts in Prices and Premiums Affecting Willingness to Accept or Pay



Source: Produced by SAS program from outputs of SPSS program from field survey data. March 2016.

The details of the analyzed market prices are presented separately in MS Excel files attached to this report. The data collected were used in SPSS and SAS statistical programs for analysis on the respective attributes and expected outputs of analysis.

Factors affecting price sensitivity effects (PSE) on preparedness and willingness to accept or pay.

The study examined the key factors affecting price sensitivity effects (PSE) on preparedness and willingness to accept or pay by two groups of aggregators (the NEMAs and EMAs).

Table 17 and Figure 7 clearly show that the effect on the sensitivity of market premiums is strongest (highest) in Tamale and Techiman markets where the PSE values exceed 0.5 (the optimal value of sensitivity).

Table 17. Factors Influencing Price Sensitivity Effects on Preparedness and Willingness to Accept or Pay Premiums by Near-End Market Aggregators

Effect on Sensitivity	Scale	Tamale	Bolgatanga	Techiman
Market prices (hikes, troughs, seasonality, etc.).	Weight	Strong	Mild	Weak
	PSE value	0.56	0.37	0.18
Product preferences (variety, uses, taste, etc.).	Weight	Excessive	Mild	Strong
	PSE value	0.73	0.36	0.58
Quality preferences (clean, sorted, and graded products, aflatoxin-free status, pest and disease tolerance/resistance, etc.).	Weight	Weak	Mild	Strong
	PSE value	0.17	0.38	0.52
Price pushing force factors (external demand, rising price changes, etc.).	Weight	Strong	Mild	Strong
	PSE value	0.57	0.26	0.58
Price pulling force factors (external supply, falling price changes, shifts in preferences etc.).	Weight	Mild	Excessive	Weak
	PSE value	0.40	0.67	0.48
Summary ratio (price sensitivity effects on aggregators in specific market.	Weight	Strong	Weak	Strong
	PSE value	0.60	0.18	0.56

Source: Produced by SAS program from outputs of SPSS program from field survey data. March 2016.

Scale:

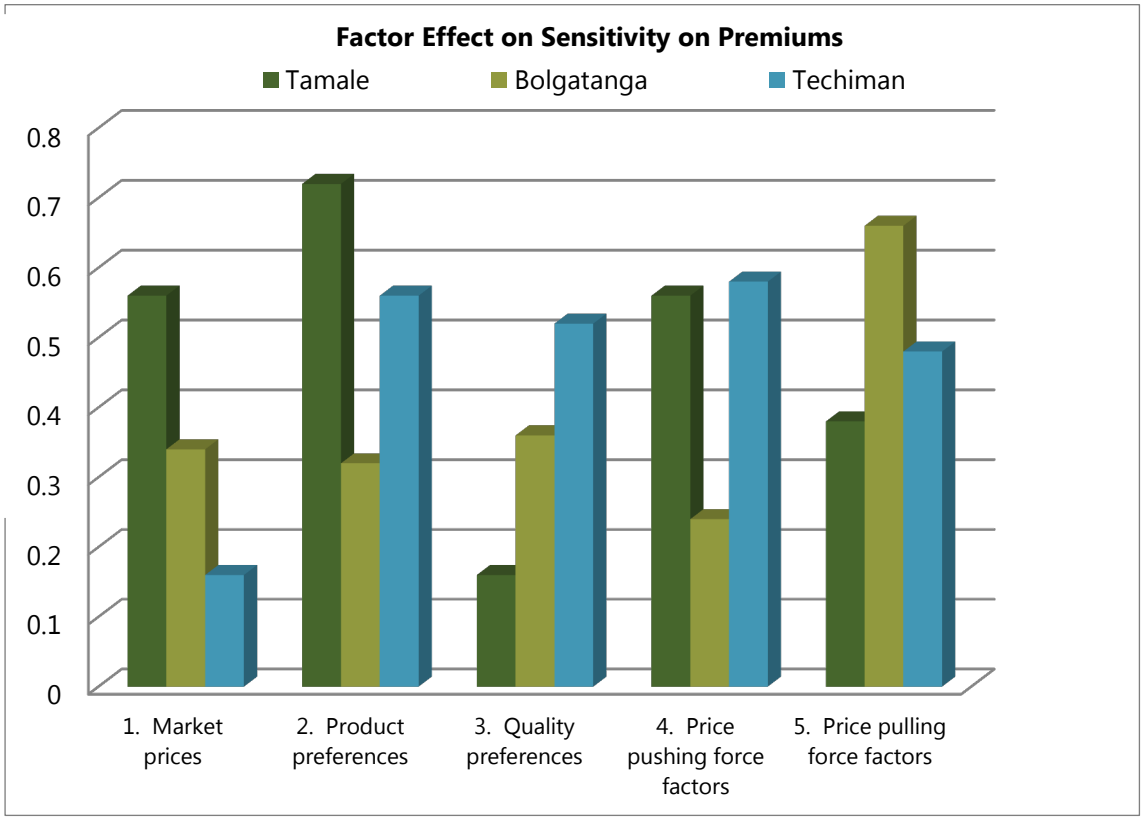
PSE value	0.1. – 0.20	0.21 – 0.40)	0.41 – 0.60	0.61 – 1.0
Effect on market premium	Weak	Mild	Strong	Excessive

By sensitivity factor, it was observed that product preference factors are the most influential in the sensitivity of market premiums, followed by price pulling factors over the three-year period (2013/14 to 2015/16).

Figures 6 and 7 present the factor effects and price sensitivity effects on—

- sensitivity of market premiums in the near-end markets
- sensitivity of end market aggregators toward accepting or paying market premiums.

Figure 6. Factor Effect on Sensitivity toward Accepting/Rejecting Market Premiums in Three Near-End Markets



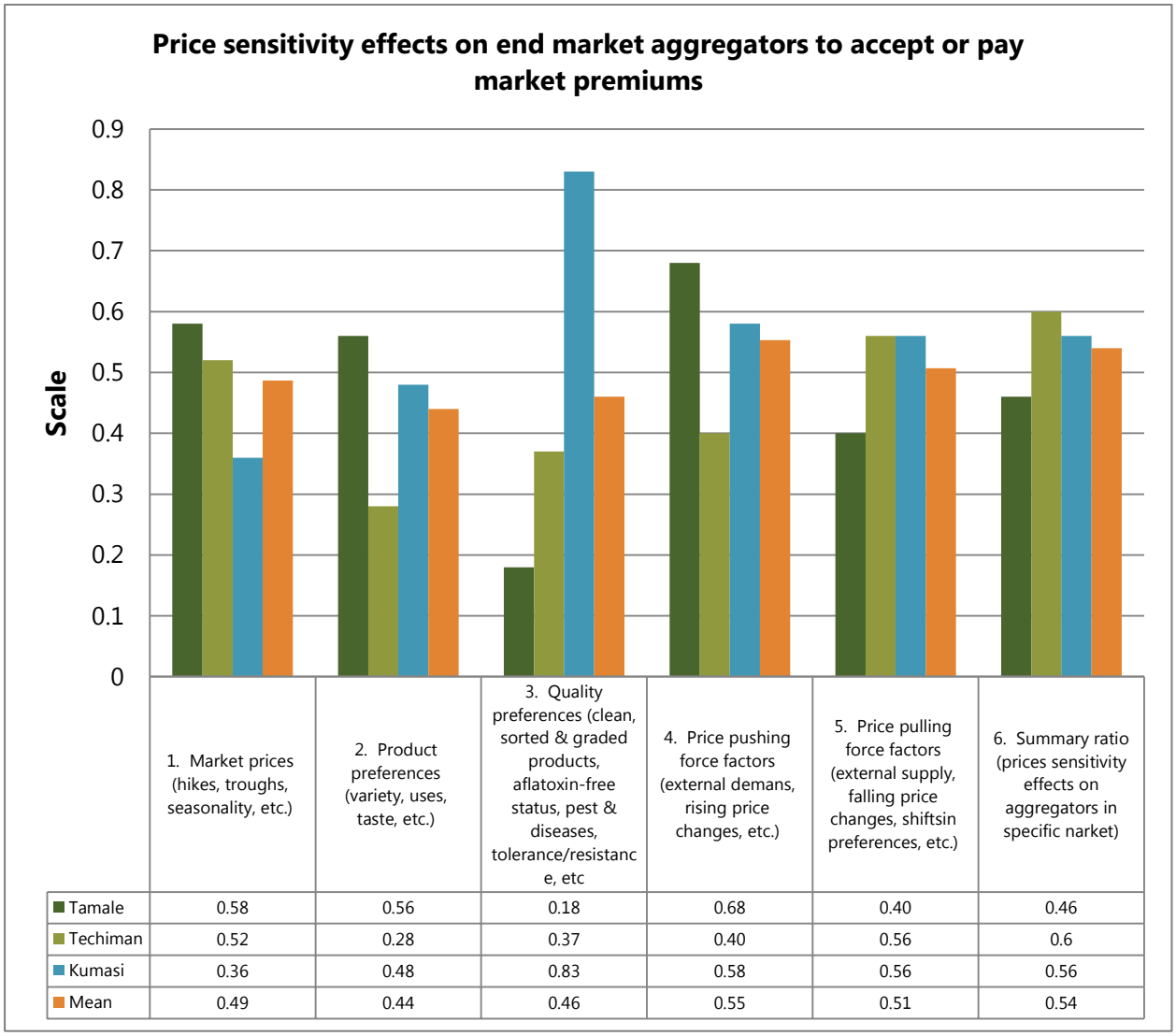
Source: Produced by SAS program from outputs of SPSS program from field survey data, March 2016.

NEMAs in the Tamale near-end market (blue) are most influenced (at more than 0.5 or 50 percent) by two factors: market prices and product preferences. The NEMAs in Bolgatanga (red) were more affected by price pulling factors, at more than 50 percent. For NEMAs in Techiman (green), product preferences and price pushing force factors affected NEMAS sensitivity to premiums (quality preferences did not affect sensitivity to premiums).

Price sensitivity effects on end market aggregators to accept or pay market premiums

Factors influencing price sensitivity effects (PSE) on preparedness and willingness to accept or pay premiums by end market aggregators in Tamale, Techiman, and Kumasi were analyzed. Figure 7 shows that quality preferences were highest in Kumasi and lowest in Tamale. Factors pushing market prices were highest in Tamale and lowest in Bolgatanga near-end market. Apart from the Tamale end market, which had the lowest mean sensitivity to factor effects, there was no significant difference between the three markets (Tamale, Techiman, and Kumasi).

Figure 7. Factor Effect on Sensitivity on Market Premiums in Three End Markets (Tamale, Techniman, and Kumasi).



	1. Market prices (hikes, troughs, seasonality, etc.)	2. Product preferences (variety, uses, taste, etc.)	3. Quality preferences (clean, sorted & graded products, aflatoxin-free status, pest & diseases, tolerance/resistance, etc	4. Price pushing force factors (external demans, rising price changes, etc.)	5. Price pulling force factors (external supply, falling price changes, shiftsin preferences, etc.)	6. Summary ratio (prices sensitivity effects on aggregators in specific narket)
Tamale	0.58	0.56	0.18	0.68	0.40	0.46
Techiman	0.52	0.28	0.37	0.40	0.56	0.6
Kumasi	0.36	0.48	0.83	0.58	0.56	0.56
Mean	0.49	0.44	0.46	0.55	0.51	0.54

Source: Produced by SAS program from outputs of SPSS program from field survey data, March 2016.

Fixing Prices and Premiums by End Market Aggregators

Aggregators are key actors in the middle bracket of the price spectrum of the groundnut value chain.

There are large differences in market prices between prices paid to producers (farm-gate prices) and the final buyers (exporters and large processing/manufacturing firms). The study did not have the scope or depth to examine price gradations in the sub-segments of the aggregator markets, which span community markets, regional markets, national markets, and export and international markets.

At the lower end of the price spectrum are the community/district level value chain operators—the groundnut producers. They are primarily engaged in production (cultivation, harvesting, shelling, cleaning, and selling in small quantities). They accept prices dictated to them by the value chain actors in the middle and upper segments of the value chain.

At the community/district level, there are wide variations in market prices. As of March 2016, prices per 100 kg maxi-bag of clean, non-sorted, and non-graded groundnuts ranged between GHS 250 in Bolgatanga and GHS 320 in Tamale.[22]

In the middle segment of the groundnut value chain, the key operators are located mainly in the regional-level markets, positioned and termed as near-end markets. These include near-end markets in Tamale, Bolgatanga, Wa,[23] and Techiman.[24]

At the upper end of the groundnut price spectrum are the national-level value chain operators (located in Tamale, Techiman, Kumasi, Accra, Tema, and Takoradi),[25] which serve exporters. These key groundnut value chain actors are referred to as SMAs. They are price givers.

The EMAs determine the prices for high-quality clean, sorted, and graded groundnuts. They have the power and resources to offer higher prices (or premiums) after all costs are considered and accounted for. They are the *big buyers* who control market prices and premiums, based on the dictates of international market dynamics.

As of March 2016, the prices offered by the EMAs for 100 kg maxi-bags of clean, sorted, and graded groundnuts ranged between GHS 360 in Tamale, GHS 380 in Techiman, and GHS 400 in Kumasi and Accra. Because exporters could not be identified and contacted at the time of the study, it was impossible to obtain groundnut prices on the export or international market.

Fixing Prices and Premiums by End Market Decision Makers

Two potential end market decision makers, Avnash and PPB, were interested in contributing to collective or national consultations to determine fair market premiums on groundnuts and other produce. They noted, however, that reliable and verifiable information sources and data collection were prerequisites. They also explained that strong legislation and enforcement were needed to ensure the regulation of aflatoxin-safe markets and to guarantee sustainable premium fixing.

Until the aflatoxin scare, and the subsequent tightening of regulations by international markets, Ghana Nuts Company in Techiman and SAVNAB Company in Tamale were the principal EMAs linking the NEMAs and the export market.

[22] The distance between Tamale and Bolgatanga is approximately 160 kilometers (4–5 hours by large haulage trucks).

[23] Although there is a near-end market in Wa, it was not included in the study because the Upper West Region is outside the zone of influence (ZOI) for SPRING.

[24] The near-end market in Techiman serves the primary markets, such as those located in districts south of Wa in the western corridor of northern Ghana (Sawla, Bole, Bamboi, Banda Ahenkro, Wenchi, and Kintampo). Groundnuts from Yeji, Atebubu, Ejura, Nkoranza, and the Afram Plains are sold to aggregators in Kumasi end market.

[25] They are classified as end market aggregators (EMAs) because they are national-level operators from whom the exporters and large processing/manufacturing firms purchase their supplies. They operate at the final end of the aggregation spectrum of the groundnut value chain in Ghana.

Recommendations

The study's broad recommendations include: increase access to groundnut price information, improve aggregators' preparedness and willingness to accept or pay at given prices; facilitate regular recordkeeping and market price monitoring; and adopt regulations and practices that give fair prices and premiums to farmers for production and storage of high-quality aflatoxin-safe groundnuts.

The study proposes an innovative strategy for achieving these goals, aimed at strengthening the role of aggregators as a strategic link between producers and consumers. Aggregators need support to maintain high-quality standards, enforce aflatoxin-control regulations, and offer premiums to groundnut farmers, processors, and vendors in their respective markets.

To operationalize the strategy, the study recommends the following actions:

1. Produce a detailed mapping of groundnut market aggregators. Include all the aggregators in the primary markets, near-end markets, and end markets in the entire Savannah Accelerated Development Authority (SADA) zone.
2. Support innovative mass education and awareness-raising campaigns on high-quality standards, fair market prices, and aflatoxin-safety standards and regulations. Organize the campaigns with the state regulatory authorities and interested agencies. The campaigns should have exciting and appealing messages targeted at aggregators, peer-to-peer sessions, posted banners and signboards in markets, radio discussions on FM stations, community durbars, and all other available and accessible avenues.
3. Improve aggregators' attitudes and marketing practices using awareness-raising and educational sessions to enable them to provide fair market prices to farmers, vendors, processors, etc., and to encourage farmers to use good agricultural practices. The education and awareness sessions should encourage the aggregators to follow their religious and traditional beliefs about high moral standards in marketing, fairness in bargains and quality, and their willingness-to-pay farmers fair prices without making exorbitant profits. This should be done through cultural and religious bodies (chiefs, elders, tendana, imams, priests, and pastors). It should be part of mass education and awareness-raising on fair market prices, high quality, and reduction/elimination of aflatoxin contamination.
4. Organize and conduct intensive training for all aggregators for testing aflatoxin levels and preventing recontamination. This activity should be organized and conducted for a minimum of either a one-day session over three locations or months or three-day sessions in one location, in all the markets (primary, near-end markets, and end markets) in selected district capitals, and in Tamale, Bolgatanga, and Techiman.
5. As part of the start-up activities for aflatoxin control, subsidize and distribute simple and affordable on-the-spot aflatoxin testing kits to aggregators in all primary markets, near-end markets, and end markets. Before distribution, first provide education and training on how to use the kits, and make follow-up visits and sessions for the aggregators to ensure that the kits are functioning properly and are also well protected.
6. Strengthen aggregators associations and unions for self-regulation and their capacity and powers to abide by aflatoxin safety regulations by discounting or rejecting low quality groundnuts sold to them by farmers, producers, traders, etc., in the primary (community and district) markets and near-end (regional) markets. This should be through their unions/clubs/associations. Market leaders should be encouraged by the state regulatory authority (e.g., Food and Drug Authority, Ghana Standard Authority, MOFA-Plant Protection and Regulatory Services) to reject or discount low quality groundnuts in their markets.

7. Improve the capacities of state regulatory bodies through training and capacity development on aflatoxin control, and by providing equipment and facilities to support and regulate aggregators' activities. This activity should include providing training and resources to establish and position volunteer inspection guards at market gates to certify the quality of the groundnuts entering the markets.

Conclusion

The study pursued its research objectives by examining quantitative and qualitative data collected from aggregators in target markets. The outputs and outcomes of data analysis were applied using econometric tools. The study achieved its purpose, but additional research would be needed to address outstanding issues that could not be addressed within the study's scope and timeframe.

To promote aflatoxin-safe production and marketing practices among farmers and aggregators in northern Ghana, more in-depth research into the role and importance of end markets in aflatoxin-safety is needed. Simple and affordable on-the-spot aflatoxin testing kits should be introduced.

This study also suggested that research should be done to explain why aflatoxin reduction is not a multi-sectoral national agenda even though it is recognized as a major nutrition and health threat. Further research or investigation is warranted to determine if other successful aflatoxin-related value chain enhancements exist for aflatoxin-safe value chain development in groundnut production, marketing, consumption, and export.

Studies are also needed to investigate and assess the role and potential influence of end market decision makers—such as the Indian-financed Avnash and Hershey's' Project Peanut Butter—who were considered to be final *price givers*. End market decision makers have the potential to replace EMAs as the *powers* who could positively influence market premium-based aflatoxin control and safety regulations in Ghana.

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Annex 1. Map of Ghana Showing Study Locations

Annex 1 - Map of Ghana showing Study Locations

LEGEND:

- Main locations of interviews (market locations and interviewees were physically visited)
- Locations where phone interviews were conducted with key informants (as iterative follow-up interviews)

Annex 2. Detailed Description of Applied Research Methodology and Tools

Purpose and Objectives

Purpose of Study

The study assessed the feasibility of an aflatoxin-safe premium on groundnuts in the local and regional end markets. A small sample of formal processors and traders were surveyed to capture their knowledge of aflatoxin and determine their willingness to pay an aflatoxin-safe premium.

The final analysis considered, but was not limited to, transparency in designating safe groundnuts, testing and sorting training needs, and barriers for target farmers to access the premium market. The report was generated to recommend practical steps for SPRING to facilitate market-based incentives to reduce aflatoxin contamination in groundnuts.

The report reviews literature compiled and produced by the Peanut and Mycotoxin Innovation Lab (PMIL) at the University of Georgia, and other actors implementing aflatoxin-related activities in Ghana and elsewhere.

Applied Research Approach, Process & Methodology

Research Approach

Planned Iterative Approach

The research approach was iterative in nature, form, and process. The researcher searched for best methods, tools, data, and information.

The research focused on aggregators and, more specifically, the medium- and large-scale aggregators of aflatoxin-safe groundnuts from near-end markets in Tamale (Northern Region), Bolgatanga (Upper East Region), and in Techiman (Brong Ahafo Region). There is a reliable and credible end-market in Kumasi (Ashanti Region) where established marketing companies and international confectionery factories can be interviewed to collect data and information on market-based premiums for aflatoxin-safe groundnuts in Ghana.

The study did not look at end-markets outside of the planned zones, based on research in the near/end market sites (Tamale, Bolgatanga, Techiman, and Kumasi).

Research Layout

The layout (attributes, design, tools) of data are presented below. The contents cover both included and excluded variables.

Research Design

Experimental design: An adapted version of a randomized complete block design (RCBD) for observational analysis of a 4 x 2 x 2 market price analysis.

Research Sampling

Sampling Method: Simple sampling (using a simple randomizing technique)

Northern Region:

- 5 medium-scale aggregators in Tamale food market (near-end market)

- Tamale near-end peanut market (e.g., SAVBAN Company)

Upper East Region:

- 5 medium-scale aggregators in Bolgatanga food market (near-end market)
- Bolgatanga near-end peanut market *(yet clearly identified)*

Brong-Ahafo Region:

- 2–3 large-scale aggregators in Techiman near-end markets
- (1–2 large-scale aggregators or factories (e.g., Ghana Nuts Co.) in Techiman

Ashanti Region:

- 2–3 medium-scale aggregators Kumasi end markets
- 1–2 large-scale aggregators or factories (e.g., Hershey Company) in Kumasi

Sample population: 40 aggregators

Medium-scale aggregators: 10 near-end aggregators (5 each in Tamale and Bolgatanga)

Large-scale aggregators: 4–6 near-end market aggregators (2–3 each in Techiman and Kumasi)

National-scale aggregators/factories: 2–4 end-market aggregators/factories (1–2 each in Techiman and Kumasi)

Data Collection Tools/Techniques

1. Quantitative data collection
    - Primary sources (business records of aggregators and/or factories)
    - Secondary data sources (from peer-reviewed journal reports)
2. Qualitative information collection
    - Focus groups discussions
    - Key informant/in-depth interviews
    - Projective/speculative techniques

Research Process

Research Background

Demographic information

Marketing information (distribution, varieties, scale of aggregation, market prices)

Analysis (price sensitivity analysis)

Market premium (variety, scale, capacity, and willingness to pay)

Independent variables (to test and measure)

Prices (4 price points)

Aggregators (2 scales of aggregation)

Varieties (2 groundnut varieties)

Dependent variable

Market premium (effect/influence of independent variables)

Validity (statistical tests of validity of independent variable)

Research Information

Quantitative information (varieties, scale, and prices)

Qualitative information (knowledge and perceptions of market premiums)

Market price facilitators (incentives, disincentives, facilities, regulative measures, etc.)

Research Outputs

Qualitative outputs

Price distribution and seasonality (price-over-season)

Market premium and discounts

Level of specificity/generalization (tests of statistical significance and confidence levels)

Research Process

Steps in the Applied Research Process and Methodology

The standard applied research process included:

- preparation and planning of the research process and methods
- design and layout of the research process and methods
- execution and monitoring of the research process and methods
- presentation and dissemination of outputs and outcomes

Detailed descriptions of the steps in the research process and methods are presented in the ensuing sections.

Preparation and planning of the Research Process and Methods

- ensuring that the basis and criteria for classifying the type of research is appropriate to the research objectives
- providing a strong basis for the research on market premiums, incentives, and support for value chain actors in aflatoxin-safe groundnuts
- understanding the prevalence, benefits, and advantages of market premiums, incentives, and support
- analyzing trends and features in the sensitivity of conventional prices and market premiums (seasonal fluctuations, supply and demand dynamics, price stability, risks and disturbances)
- identifying structures and systems for market premiums, incentives, support, regulations, etc.
- promoting and sustaining certification and traceability of raw or processed products from aflatoxin-safe groundnuts.

Design and Layout of the Research Process and Methods

The research design and layout are presented below.

A. Sources

- primary sources: desk studies, surveys, physical inspection, field visits, etc.
- secondary sources: literature review, bulletins, reports, print media

B. Methods

- desk study on project reports, documentation, etc.
- surveys for collection of quantitative data and qualitative information
- review of project reports, project documents, and existing literature on current research
- analysis, determination, tests, and validation of outputs and information computations.

C. Tools

Tools for collecting, assembling, and analyzing data and information
Tools for analysis (models, software, etc.).
Tools for tests, validation, and triangulation of findings and recommendations

The tools were applied to a price sensitivity analysis, based on the following points of analysis:

Four (4) price points:

Two (2) harvesting price points (start of season: Sept. 30/Oct. and end of season: Nov. 30/Dec.).[26]

Two (2) storage price points: (start of storage season: Mar. 30 /Apr. and end of storage season: Jun. 30/Jul.).[27]

Two (2) aggregator points:

End-market (large-scale) aggregators – national/first-level price takers

Near-end (medium-scale) aggregators – regional/second-level price takers

Execution and Monitoring of the Research Process and Methods

The researcher executed and monitored the whole research process by performing in-depth analysis of premiums, incentives, and support for aflatoxin-safe groundnuts. The research included, but was not limited to, an analysis of:

- knowledge and practices in high quality value chain processes and actions in aflatoxin-safe groundnuts
- threats, perceptions and attitudes in market premiums, incentives and support in promoting aflatoxin-safe groundnuts
- sensitivity of conventional prices and market premiums (fluctuations, stability, risks, etc.)
- willingness and ability to pay market premiums to value chain actors (farmers, traders, etc.)
- capacity and willingness to eliminate/reduce effects of disincentives and inadequate support.

A detailed description of the choice of tools and selected method of analysis are presented in section 3.0.

[26] *Note: Applicable price points are September and November if it is a low rainfall year and October and December if it is a high rainfall year.*

[27] Note: Applicable price points are March and June if it is a low rainfall year and April and July if it is a high rainfall year.

Research Restrictions/Exclusions/Exemptions

The following research attributes and variables were exempted from the study because they did not focus on the parameters needed for expected outputs.

Research design

The design is restricted to an adapted randomized complete block design (RCBD) for observational analysis of the 4 x 2 market price analysis.

Independent variables not included

a) production (good agricultural practices)
b) rainfall years (wetter or drier years)
c) volumes (quantities of aggregation or marketing)
d) quality (cleaning, sorting and grading)
e) uses (crushing, confectioneries, etc.)
f) incentives and disincentives
g) supportive regulatory measures

Dependent variables not included

a) practices (production, post-harvest, storage, transportation, etc.)
b) market trends (production, volumes, quality, imports, exports, etc.)

Detailed Description of Method of Analysis

A detailed description of the method of analysis, including standard steps taken to ensure consistency, are presented below.

Econometric Analysis

a) Partial Budgeting

Partial budgeting is a planning and decision-making framework used to compare the costs and benefits of alternatives faced by a farm business. It focuses only on the changes in income and expenses that would result from implementing a specific alternative. All aspects of farm profits that are unchanged by the decision can be safely ignored. Thus, partial budgeting can help determine how a given decision will affect the profitability of a farm.

Partial budgeting is simply the evaluation of the impact on farm profit resulting from a proposed management change. The partial budget framework can be used to analyze a number of important farm decisions, including i) adopting a new production technology, ii) changing or adding enterprises, and iii) modifying production practices. Four basic questions must be answered during the preparation of a partial budget: i) What new or additional costs will be incurred? ii) How much current income will be lost or reduced? iii) What new or additional income was received? iv) What current costs were reduced or eliminated?

b) Conventional and Premium Price Sensitivity Analysis

Price sensitivity (also known as price elasticity of demand) is the degree to which consumers' behaviors are affected by the price of the product or service. It includes the extent to which the price of a particular product or service is affected, and how consumer demand for a product is changed by the cost of the product. Price

sensitivity analysis helps suppliers or manufacturers study consumer behavior and assists them in making informed decisions. The level of price sensitivity varies depending on product and consumer.

Lack of critical information on what consumers are willing to pay is an important challenge. Moreover, these pricing strategies are subjective, depending largely on the judgment of management rather than data-driven empirical evidence to determine the impact of distinctive pricing levels on demand.

Selected Analytical Software

a) SAS software

Statistical Analysis Software (SAS) is a software suite used to search, transform, manage, and retrieve data from a variety of sources and perform statistical analysis on it. Specifically, SAS/STAT is used to meet both specialized and enterprise-wide statistical needs of a variety of users. Its capacities cover traditional analysis of variance, multi-linear regression, and Bayesian inference. It uses high-performance modelling tools for complete and comprehensive data analysis. SAS provides a graphical user interface for non-technical users and more advanced options through the SAS programming language.

SAS programs have a "DATA" step, which retrieves and manipulates data by creating data sets, and a "PROC" step, which analyzes the data. Each step consists of a series of statements. The DATA step uses "executable statements" to execute actions, and "declarative statements" to provide instructions to read a data set or alter its appearance. The DATA step is carried out in two phases: compilation and execution. In the compilation phase, declarative statements are processed and syntax errors are identified. Afterwards, the execution phase processes each executable statement sequentially. Data sets are organized into tables with rows called "observations" expressed by "descriptors," and columns called "variables" expressed by "values."

b) Monte Carlo @RISK Simulation software

The Monte Carlo "@RISK Simulation software was developed to perform risk analysis in a spreadsheet model, using Monte Carlo simulation to show many possible outcomes and their probability of occurring. The software mathematically and objectively computes and tracks many different possible future scenarios, and presents the probabilities and risks associated with each different scenario. From its outputs, users can determine the best decision-making options under uncertainty, thus evaluating the risks to take or to avoid.

Risk management strategies can be planned and analyzed using the @RISK model through the integration of a "RISKOptimizer," which is used with Monte Carlo simulation to optimize spreadsheets with uncertain values, and determines the best allocation of resources, optimal asset allocation, most efficient schedule, and much more.

For the purposes of assessing the level of risk associated with the market premium for aflatoxin-safe groundnuts, the "RISKOptimizer" was applied.

Source: http://www.palisade.com/projectriskmanagement/

Annex 3. Checklist for Focus Group Discussions and Key Informant Interviews

A. Key Issues for Discussions and Interviews

1. Actors and adopters of aflatoxin-safe technologies in groundnut value chain
2. Key issues related to aflatoxins and other mycotoxins
3. Drivers and mediators of threats and constraints to adoption of market premiums
4. Incentives, and their associated risks and mitigation
5. Local and regional end-markets for aflatoxin-safe market premium
6. Knowledge of practices applied to reduce exposure to aflatoxin
7. Willingness-to-pay for an aflatoxin-safe premium on groundnuts
8. Key issues of transparency in designating safe groundnuts
9. Salient barriers that confront farmers in accessing premium markets
10. Potential adopters of market premium on aflatoxin-safe groundnut
11. Practical steps for facilitating market-based incentives for aflatoxin reduction

B. Farmers' Capacities for Working with Market Premium Groundnuts

1. Willingness
2. Preparedness
3. Interests
4. Acceptance
5. Adoption
6. Internalization
7. Commitment
8. Defence
9. Adaptation
10. Promotion
11. Sustenance

C. Value Chain Actors' Issues in Adopting and Sustaining Market Premiums

1. Knowledge and experience
2. Practices and skills
3. Beliefs and perceptions
4. Attitude and behavior
5. Willingness and preparedness
6. Motivation and incentives
7. Technical/logistical and financial support
8. Promoters and inhibitors to adherence
9. Regulations, incentives, and sanctions

Annex 4. Detailed Data on Seasonal (Quarterly) Prices

Table 18. Buying and Selling Prices and Profits (Harvest Quarter 1) in 2013/2014 Market Year

2013/2014 Harvest Point 1 (Buying Prices)		
	No. of Aggregators	Percent (%)
GHS 250	3	14.3
GHS 255	5	23.8
GHS 260	5	23.8
GHS 265	2	9.5
GHS 290	1	4.8
GHS 295	3	14.3
GHS 300	2	9.5
Total	***21***	***100.0***

2013/2014 Harvest Point 1 (Selling Prices)		
	No. of Aggregators	Percent (%)
GHS 260	2	9.5
GHS 270	8	38.1
GHS 280	5	23.8
GHS 320	6	28.6
Total	***21***	***100.0***

2013/2014 Harvest Point 1 (Profit)		
	No. of Aggregators	Percent (%)
GHS 5	1	4.8
GHS 10	3	14.3
GHS 15	6	28.6
GHS 20	7	33.3
GHS 25	3	14.3
GHS 30	1	4.8
Total	***21***	***100.0***

Table 19. Buying and Selling Prices and Profits (Harvest Quarter 2) in 2013/2014 Market Year

2013/2014 Harvest Point 2 (Buying Prices)		
	No. of Aggregators	Percent (%)
GHS 255	1	4.8
GHS 265	5	23.8
GHS 270	6	28.6
GHS 275	3	14.3
GHS 320	3	14.3
GHS 335	1	4.8
GHS 350	1	4.8
GHS 365	1	4.8
Total	***21***	***100.0***

2013/2014 Harvest Point 2 (Selling Prices)		
	No. of Aggregators	Percent (%)
GHS 270	1	4.8
GHS 280	8	38.1
GHS 285	1	4.8
GHS 290	5	23.8
GHS 340	3	14.3
GHS 360	2	9.5
GHS 380	1	4.8
Total	***21***	***100.0***

2013/2014 Harvest Point 2 (Profit)		
	No. of Aggregators	Percent (%)
GHS 10	5	23.8
GHS 15	9	42.9
GHS 20	6	28.6
GHS 25	1	4.8
Total	***21***	***100.0***

Table 20. Buying and Selling Prices and Profits (Storage Quarter 1) in 2013/2014 Market Year

2013/2014 Storage Point 1 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 255	1	4.8
GHS 270	3	14.3
GHS 275	4	19.0
GHS 280	3	14.3
GHS 285	4	19.0
GHS 290	1	4.8
GHS 370	1	4.8
GHS 375	4	19.0
Total	***21***	***100.0***

2013/2014 Storage Point 1 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 290	2	9.5
GHS 300	13	61.9
GHS 310	1	4.8
GHS 400	2	9.5
GHS 410	3	14.3
Total	***21***	***100.0***

2013/2014 Storage Point 1 (Profit)		
	No. of Aggregators	Percent (%)
GHS 10	1	4.8
GHS 15	4	19.0
GHS 20	4	19.0
GHS 25	5	23.8
GHS 30	2	9.5
GHS 35	4	19.0
GHS 40	1	4.8
Total	***21***	***100.0***

Table 21. Buying and Selling Prices and Profits (Storage Quarter 2) in 2013/2014 Market Year

2013/2014 Storage Point 2 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 280	1	4.8
GHS 285	2	9.5
GHS 290	2	9.5
GHS 295	8	38.1
GHS 305	2	9.5
GHS 380	1	4.8
GHS 385	3	14.3
GHS 395	2	9.5
Total	***21***	***100.0***

2013/2014 Storage Point 2 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 300	3	14.3
GHS 310	4	19.0
GHS 320	8	38.1
GHS 420	6	28.6
Total	***21***	***100.0***

2013/2014 Storage Point 2 (Profit)		
	No. of Aggregators	Percent (%)
GHS 10	1	4.8
GHS 15	6	28.6
GHS 20	8	38.1
GHS 25	2	9.5
GHS 35	3	14.3
GHS 40	1	4.8
Total	***21***	***100.0***

Table 22. Buying and Selling Prices and Profits (Harvest Quarter 1) in 2014/2015 Market Year

2014/2015 Harvest Point 1 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 240	1	4.8
GHS 245	2	9.5
GHS 250	2	9.5
GHS 255	1	4.8
GHS 260	3	14.3
GHS 265	8	38.1
GHS 270	3	14.3
GHS 275	1	4.8
Total	***21***	***100.0***

2014/2015 Harvest Point 1 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 260	2	9.5
GHS 270	3	14.3
GHS 280	11	52.4
GHS 290	3	14.3
GHS 300	2	9.5
Total	***21***	***100.0***

2014/2015 Harvest Point 1 (Profit)		
	No. of Aggregators	Percent (%)
GHS 10	2	9.5
GHS 15	12	57.1
GHS 20	2	9.5
GHS 25	2	9.5
GHS 30	2	9.5
GHS 50	1	4.8
Total	***21***	***100.0***

Table 23. Buying and Selling Prices and Profits (Harvest Quarter 2) in 2014/2015 Market Year

2014/2015 Harvest Point 2 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 265	2	9.5
GHS 270	1	4.8
GHS 280	5	23.8
GHS 285	10	47.6
GHS 290	1	4.8
GHS 295	1	4.8
GHS 305	1	4.8
Total	***21***	***100.0***

2014/2015 Harvest Point 2 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 280	2	9.5
GHS 290	2	9.5
GHS 300	14	66.7
GHS 310	2	9.5
GHS 320	1	4.8
Total	***21***	***100.0***

2014/2015 Harvest Point 2 (Profit)		
	No. of Aggregators	Percent (%)
GHS 10	1	4.8
GHS 15	14	66.7
GHS 20	6	28.6
Total	***21***	***100.0***

Table 24. Buying and Selling Prices and Profits (Storage Quarter 1) in 2014/205 Market Year

2014/2015 Storage Point 1 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 285	2	9.5
GHS 290	1	4.8
GHS 295	8	38.1
GHS 300	8	38.1
GHS 305	1	4.8
Total	***21***	***100.0***

2014/2015 Storage Point 1 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 260	2	9.5
GHS 270	3	14.3
GHS 280	11	52.4
GHS 290	3	14.3
GHS 300	2	9.5
Total	***21***	***100.0***

2014/2015 Storage Point 1 (Profit)		
	No. of Aggregators	Percent (%)
GHS 15	4	19.0
GHS 20	13	61.9
GHS 25	1	4.8
GHS 30	2	9.5
GHS 45	1	4.8
Total	***21***	***100.0***

Table 25. Buying and Selling Prices and Profits (Storage Quarter 2) in 2014/205 Market Year

2014/2015 Storage Point 2 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 280	1	4.8
GHS 315	1	4.8
GHS 320	1	4.8
GHS 324	1	4.8
GHS 325	1	4.8
GHS 330	1	4.8
GHS 335	1	4.8
GHS 340	3	14.3
GHS 345	2	9.5
GHS 350	2	9.5
GHS 355	1	4.8
GHS 360	1	4.8
GHS 365	5	23.8
Total	***21***	***100.0***

2014/2015 Storage Point 2 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 300	1	4.8
GHS 340	3	14.3
GHS 350	2	9.5
GHS 360	5	23.8
GHS 370	2	9.5
GHS 380	4	19.0
GHS 390	3	14.3
GHS 400	1	4.8
Total	***21***	***100.0***

2014/2015 Storage Point 2 (Profit)		
	No. of Aggregators	Percent (%)
GHS 10	1	4.8
GHS 15	5	23.8
GHS 16	1	4.8
GHS 20	4	19.0
GHS 25	5	23.8
GHS 30	3	14.3
GHS 35	1	4.8
GHS 40	1	4.8
Total	***21***	***100.0***

Table 26. Buying and Selling Prices and Profits (Harvest Quarters 1 and 2) in 2015/2016 Market Year

2015/2016 Harvest Point 1 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 85	1	4.8
GHS 290	1	4.8
GHS 295	2	9.5
GHS 300	7	33.3
GHS 305	4	19.0
GHS 340	4	19.0
GHS 345	2	9.5
Total	***21***	***100.0***

2015/2016 Harvest Point 1 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 300	1	4.8
GHS 310	1	4.8
GHS 320	13	61.9
GHS 330	1	4.8
GHS 360	5	23.8
Total	***21***	***100.0***

2015/2016 Harvest Point 1 (Profit)		
	No. of Aggregators	Percent (%)
GHS 15	7	33.3
GHS 20	11	52.4
GHS 25	2	9.5
GHS 30	1	4.8
Total	***21***	***100.0***

Table 27. Buying and Selling Prices and Profits (Harvest Quarter 2) in 2015/2016 Market Year

2015/2016 Harvest Point 2 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 320	8	38.1
GHS 330	3	14.3
GHS 340	3	14.3
GHS 345	1	4.8
GHS 350	2	9.5
GHS 355	1	4.8
GHS 360	3	14.3
Total	***21***	***100.0***

2015/2016 Harvest Point 2 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 340	8	38.1
GHS 350	1	4.8
GHS 360	6	28.6
GHS 370	1	4.8
GHS 380	4	19.0
GHS 400	1	4.8
Total	***21***	***100.0***

2015/2016 Harvest Point 2 (Profit)		
	No. of Aggregators	Percent (%)
GHS 10	1	4.8
GHS 15	2	9.5
GHS 20	12	57.1
GHS 30	5	23.8
GHS 40	1	4.8
Total	***21***	***100.0***

Table 28. Buying and Selling Prices and Profits (Storage Quarter 1) in 2015/2016 Market Year[28]

2015/2016 Storage Point 1 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 335	1	4.8
GHS 340	2	9.5
GHS 355	3	14.3
GHS 360	7	33.3
GHS 365	1	4.8
GHS 370	1	4.8
GHS 380	5	23.8
GHS 385	1	4.8
Total	***21***	***100.0***

2015/2016 Storage Point 1 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 360	3	14.3
GHS 370	2	9.5
GHS 380	8	38.1
GHS 390	1	4.8
GHS 400	6	28.6
GHS 410	1	4.8
Total	***21***	***100.0***

2015/2016 Storage Point 1 (Profit)		
	No. of Aggregators	Percent (%)
GHS 15	3	14.3
GHS 20	14	66.7
GHS 25	3	14.3
GHS 35	1	4.8
Total	***21***	***100.0***

Table 29. Buying and Selling Prices and Profits (Storage Quarter 2) in 2015/2016 Market Year[29]

2015/2016 Storage Point 2 (Buying Price)		
	No. of Aggregators	Percent (%)
GHS 360	3	14.3
GHS 370	2	9.5
GHS 380	10	47.6
GHS 390	1	4.8
GHS 395	2	9.5
GHS 400	3	14.3
Total	***21***	***100.0***

2015/2016 Storage Point 2 (Selling Price)		
	No. of Aggregators	Percent (%)
GHS 380	1	4.8
GHS 400	10	47.6
GHS 410	2	9.5
GHS 420	6	28.6
GHS 440	2	9.5
Total	***21***	***100.0***

2015/2016 Storage Point 2 (Profit)		
	No. of Aggregators	Percent (%)
GHS 20	10	47.6
GHS 25	4	19.0
GHS 30	5	23.8
GHS 40	2	9.5
Total	***21***	***100.0***

[28] These projected prices were predicted by the aggregators for Storage Quarter 1 (April – June 2016).

[29] These projected prices were predicted by the aggregators

Table 30. Market Prices according to Quality and Market Premium (in 2014/2015 Market Year)

Low Quality Conventional Non-Premium Market Price		
	No. of Aggregators	Percent (%)
GHS 360	16	76.2
GHS 370	5	23.8
Total	***21***	***100.0***

High Quality Non-Premium Market Price		
	No. of Aggregators	Percent (%)
GHS 400	15	71.4
GHS 410	6	28.6
Total	***21***	***100.0***

High Quality Market Premium Price		
	No. of Aggregators	Percent (%)
GHS 470	1	4.8
GHS 475	1	4.8
GHS 480	17	81.0
GHS 495	2	9.5
Total	***21***	***100.0***

Table 31. Aggregators' Monthly Average Income and Expenditure (in 2014/2015 Market Year)

Monthly Income		
	No. of Aggregators	Percent (%)
GHS 2400	15	71.4
GHS 2600	6	28.6
Total	***21***	***100.0***

Monthly Expenditure		
	No. of Aggregators	Percent (%)
GHS 1800	1	4.8
GHS 1850	2	9.5
GHS 2000	5	23.8
GHS 2100	1	4.8
GHS 2200	3	14.3
GHS 2300	3	14.3
GHS 2400	4	19.0
GHS 2550	2	9.5
Total	***21***	***100.0***

Annex 5. Detailed information on Groundnut Markets (Locations, Scale, Monthly Volumes, Most Common Varieties, Source and Destination Markets)

Table 32. Location of Aggregators in Markets

Location of Aggregators in Markets					
		No. of Aggregators	**Percent (%)**	**Valid Percent**	**Cumulative Percent**
Valid	Tamale	8	38.1	38.1	38.1
	Bolga	7	33.3	33.3	71.4
	Techiman	6	28.6	28.6	100.0
	Total	21	100.0	100.0	

Table 33. Scale of Aggregation

Scale of Aggregation					
		No. of Aggregators	**Percent (%)**	**Valid Percent**	**Cumulative Percent**
	Medium-scale	13	61.9	61.9	61.9
	Large-scale	8	38.1	38.1	100.0
	Total	**21**	**100.0**	**100.0**	

Table 34. Scale and Monthly Volumes of Groundnuts Marketed from Upper East Region and Northern Region (2014/2015)

Scale and Monthly Volumes of Groundnuts Marketed from Upper East Region (2014/2015)		
	No. of Aggregators	**Percentage (%)**
Scale 1 (15–25 MT)	3	14.3
Scale 2 (25–30 MT)	1	4.8
Scale 3 (25–35 MT)	1	4.8
Scale 4 (100–150 MT)	4	19.0
Scale 5 (150–200 MT)	5	23.8
Scale 6 (150–300 MT)	1	4.8
Scale 6 (300–500 MT)	4	19.0
Scale 7 (500–800 MT)	2	9.5
Total	***21***	***100.0***

Scale and Monthly Volumes of Groundnuts Marketed from Northern Region (2014/2015)		
	No. of Aggregators	**Percentage (%)**
Scale 1 (100–20 0MT)	4	19.0
Scale 2 (200–350 MT)	2	9.5
Scale 3 (300–3500 MT)	4	19.0
Scale 4 (350–450 MT)	1	4.8
Scale 5 (400–500 MT)	1	4.8
Scale 6 (450–500 MT)	4	19.0
Scale 7(500–7600 MT)	1	4.8
Scale 8 (500–800 MT)	2	9.5
Scale 9 (800–15000 MT)	2	9.5
Total	***21***	***100.0***

Table 35. Most Common Varieties Marketed from Upper East Region and Northern Region

Most Common Varieties Marketed from Upper East Region		
	No. of Aggregators	**Percentage (%)**
Manipinta, Chinese, Sinkarzie	8	38.1
Sinkarzie, Dobba, Chinese	10	47.6
Chinese, Manipinta, Sinkarzie	3	14.3
Total	***21***	***100.0***

Most Common Varieties Marketed from Northern Region		
	No. of Aggregators	**Percentage (%)**
Bugla, Abain, Simbalgu	12	57.1
Abain, Chinese, Bugla, Simbalgu	4	19.1
Simbalgu, Chinese, Sinkarzie	5	23.8
Total	**21**	**100.0**

Table 36. Source and Destination Markets of Groundnuts in Upper East Region and Northern Region

Source Markets (Upper East Region)			Source Markets (Northern Region)			Destination Markets		
	No. of Aggregators	Percent (%)		No. of Aggregators	Percent (%)		No. of Aggregators	Percent (%)
Mankarigu, Fumbisi	4	19.0	Yendi, Gushiegu, Karaga	3	14.3	Salaga, Techiman, Kumasi, Accra	2	9.5
Putinga (Burkina Faso)	6	28.6	Tamale, Savelugu, Tolon	3	14.3	Buipe, Kumasi, Takoradi, Cape Coast, Oboasi	3	14.3
Bawku, Garu, Burkina Faso	5	23.8	Yendi, Gushiegu, Savelugu, Tolon	1	4.8	Techiman, Tamale, Ejura, Sunyani	6	28.6
Wa, Leo, Burkina Faso	5	23.8	Yendi, Gambaga, Nakpanduri	2	9.5	Sunyani, Mampong, Tema, Kumasi	7	33.3
Navrongo, Kumbisiri, Bawku,	1	4.8	Gambaga, Walewale	12	57.1	Elimina, Mankasim, Konongo	3	14.3
Total	***21***	***100.0***	***Total***	***21***	***100.0***	***Total***	***21***	***100.0***

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