

**ASHESI UNIVERSITY COLLEGE**

**FEASIBILITY OF GHANA'S COMMODITIES EXCHANGE WITH  
RESPECT TO CURRENT CROP YIELD AND WAREHOUSING  
FACILITIES**

By

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Administration

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## **DECLARATION**

**I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.**

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**I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by Ashesi University College.**

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## **ABSTRACT**

The Government of Ghana has committed to establishment of the Ghana Commodity Exchange (GCX) to create orderly, transparent, and efficient marketing system for its key commodities with the objectives of promoting agricultural investment, enhancing productivity, encouraging market access and fair returns for smallholder farmers, and facilitating the formalization of informal agricultural trading activities.

This dissertation was conducted to determine the whether the current crop yields and available warehousing facilities would support the commencement of the proposed Agricultural commodities exchange that is to be established in Ghana.

The study was conducted by collecting data from key players involved in the establishment of the exchange. People interviews include representatives from Ministry of Trade and Industry, National Buffer Stock Company, Ghana Grains Council and Securities and Exchange Commission.

The research findings revealed that Ghana's crop yield is capable of supporting the exchange, however her warehousing facilities are in dearth and as such the government should invest in quality warehousing for the commodities.

**Key words: Ghana commodities exchange, crop yields, commodity, warehouse, capital investment and standards.**

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# **Chapter 1: Introduction**

## **1.1 Introduction**

The aim of this thesis was to determine where Ghana's current crop production levels and available warehousing facilities would support the commencement of the Agricultural commodities exchange.

It sought to provide the reader with a practical understanding of the agricultural commodities exchange that is to be set up in Ghana. It also highlighted an important factor in setting up an exchange that is the ready availability of commodities when needed in order to avoid shortages or failures as well as a robust warehousing system.

Thus, the title "Feasibility of the Ghana commodities exchange with respect to current crop yield and warehousing facilities."

## **1.2 Background**

Commodities are defined as products, which have some commercial value, which can be manufactured, purchased, sold or consumed (Association of Ghana Industries, 2012). They mainly belong to the primary sector of the economy including agricultural goods such as corn, barley, cotton, cocoa and extractable raw materials of which crude oil and gas are included (Association Of Ghana Industries, 2012).

A Commodities exchange on the other hand is a market in which multiple buyers and sellers trade commodity-linked contracts on the basis of rules and procedures laid down by the exchange (UNCTAD, 2007).

Commodities markets and trading dates back to the trading of rice

futures in the 17<sup>th</sup> century in Osaka, Japan (UNCTAD, n.d.). However, the world's oldest commodities exchange based in Chicago USA was established in 1848 (NEPAD, 2009). This exchange was organized to connect the farmers of Midwestern America to the buyers and sell their produce at reasonable prices, reduce exploitation by middlemen and earn profits (NEPAD, 2009).

With the advent of technology, the shape of commodities exchanges has changed drastically in the last decades. The future trading system has come to replace the spot or cash exchange to ensure a year-round supply of seasonal agricultural products.

Electronic trading has led to the emergence of a dozen globalized exchanges, accounting for three-quarters of the volume in futures traded. In 2000, nearly 3 billion contracts were traded on futures and options exchanges, representing a 16% increase compared to 1999 (UNCTAD, n.d.).

At present, there are major commodity exchanges in over twenty countries, including the United States, the United Kingdom, Germany, France, Japan, the Republic of Korea, Brazil, Australia Singapore, Ethiopia and South Africa amongst others (UNCTAD, n.d.).

These exchanges have ensured an all year round supply of agricultural products throughout the world (UNCTAD, n.d.). In addition, through the centralization of trading activities and the transparency of exchanges, all parties are aware of the various commodity prices before trading hence the interest of farmers are adequately sought after.



### **1.3 Problem Statement**

There has been growing interest in promoting commodity exchanges in Ghana since the early 1990s when agricultural marketing systems were liberalized (Onumah, 2010). The liberalization of the agricultural sector was part of reforms to modernize and improve the performance of agricultural commodity marketing systems after years of poor performance. Improving agricultural marketing systems has increasingly been seen as imperative in guaranteeing successful realization of various agricultural development initiatives, which have been propelled to raise agricultural output and productivity in Ghana (Onumah, 2010).

Commodity exchanges are often viewed as a means of transforming many of the ills currently plaguing Ghana's agricultural markets including high price volatility and limited means of managing risks (Shahidur, et al., 2010). Oligopolistic market behavior and market collusion, limited formalization of contracts and quality standards which lead to infrequent payment and delivery default, low levels of participation from smallholders in formal market channels and high transaction costs throughout the system are some others. By offering a platform for competitively matching buyers with sellers, commodity exchanges can stimulate both market transparency and price discovery (Shahidur, et al., 2010).

Moreover, the nonexistence of efficient storage facilities is one of the factors that limit trading activities and contribute to high seasonal price variability in Ghana. The few storage facilities under public sector control

are not functioning as the marketing boards have been substantially scaled down. Furthermore, private sector investments in storage infrastructure are often located in urban areas and tend to assist import/export trade rather than domestic trade in the food sector (Onumah, 2010).

Storage management competence is also highly variable in Ghana and the absence of formal grading standards make it difficult to assure storability of the produce as well as its valuation, thereby making collateralization of commodities very difficult (Onumah, 2009). As a result, storage in surplus-producing areas is undertaken by ill-equipped farmers, eventually leading to very high post-harvest losses.

Owing to agricultural operations farmers, traders and processors are fully exposed to price risks with minimal opportunities to hedge against such risks. The insecurity created deters long-term planning by farmers, as they often respond on ad hoc basis to price signals. It also discourages sellers and wholesalers, distributors from investing into this sector, which could lead to an improved efficiency in trade (Onumah, 2010).

An organized market will link sellers and buyers of agricultural commodities; provide relevant and timely marketing information and intelligence; provide a transparent and competitive market price discovery mechanism. It will also harness and apply information and communication technologies (ICTs) for rural value addition and empowerment (Economy Times, 2012).

The development of agricultural commodity exchanges in Ghana has become an increasingly popular strategy for addressing some of the

ills plaguing Ghanaian food markets, including poorly developed risk management systems, high transaction costs, and limited price discovery (Onumah, 2010).

The overall goal of the Commodities Exchange is to make markets work better for farmers in Ghana, which would then lead to poverty reduction and economic growth.

#### **1.4 Objectives**

The objectives of this research paper was to investigate the adequacy of the Ghana's food production levels and storage facilities for the commencement of the commodities exchange, have been outlined below:

- ❖ To find out whether the current yield is adequate and will be able to support the commencement of the GCX
- ❖ To determine whether the available warehousing system is adequate and would support the commencement of the GCX

#### **1.5 Research questions**

- ❖ Are the current yields of crops adequate and will it be able to support the GCX's commencement?
- ❖ Are the available warehousing facilities adequate and would it support the commencement of the GCX?

#### **1.6 Significance of the study**

Essentially, this dissertation aimed to examine the adequacy of the current food production levels and warehousing available for the establishment of the paper. These conditions are propitious to the establishment of a commodities exchange and as such, a dearth or

inadequacy will cause the exchange to be inefficient in its duties. The ability of the exchange to satisfy the demands of its customers is a major factor in the establishment of the exchange as the failure to do so will result in loss of confidence in the exchange and price hikes in the economy, which may have negative implications on the economy.

Owing to this, the research topic was chosen in order to enlighten the reader on the conditions propitious for the establishment of the exchange, and in addition make the reader knowledgeable on the competence of Ghana's current food production and warehousing facilities in meeting the needs of the GCX.

### **1.7 Methodology**

Due to the objectives and research questions, the research was qualitative and exploratory in nature. Research questions were answered using quantitative and qualitative analysis. Data was analyzed using spreadsheets and presented in tables and graphs.

Interviewing key players involved in the establishment of the Ghana Commodities Exchange was the means of collecting primary data. Whereas secondary data was gathered from reports compiled by the Securities and Exchange Commission, USAID, Ministry of Trade and Industry, National Buffer Stock Company, Ghana Grains Council and the UNCTAD. Secondary data included information on current warehousing facilities, food production, the efficiencies of an exchange and other information relevant to the study.

Sampling methods used were mainly non-probabilistic specifically purposive and snowballing. These mediums were chosen because experts

on the issue were able to provide more viable information to enhance the credibility of the paper.

Conclusions and recommendations were drawn objectively from analysis of the results. The research was conducted in the Greater Accra Region, because it housed a significant number of commodity exchange experts who made considerable contributions to the study.

### **1.8 Scope of study**

The study investigated whether the current agricultural production and warehousing units are adequate in Ghana as conditions propitious to the establishment of a commodities exchange. These conditions must be catered for fully for Ghana to enjoy the full benefits of a commodities exchange.

### **1.9 Outline of dissertation**

The study is presented in five chapters:

Chapter one gives a general introduction to the study and provides a brief background of the study. The chapter also informs the reader of the problem being addressed, objectives of the study, the research questions asked, and significance of the research.

Chapter two reviews the related literature concerning the study and the theoretical framework used.

Chapter three explains the methodology employed for the research, comprising of the study design, sampling techniques and data collection methods and limitations of the study.

Chapter four illustrates and explains the data gathered during the course of the research and discusses the methods of analysis

Chapter five presents a summary of the findings, conclusions and recommendations.

## **Chapter 2: Literature Review**

### **2.1 Introduction**

In this chapter, a discussion and analysis of other literary works on the requirements such as food production levels, and adequacy of warehousing facilities, which are necessary to the establishment of agricultural commodities exchange. In order to enjoy maximum benefits from its establishment with minimum complications, these conditions must be satisfied sufficiently.

This chapter also used literature obtained from scholarly Internet journals such as UNCTAD research papers, individual and collective essays on the research topic. The analysis was intended to give the reader a profound understanding in relation to the research topic and offer a salient perspective as well.

### **2.2 Suitable conditions for efficient operation of a commodities exchange market**

A functional commodity exchange must attract a sufficient volume of trade to enable the benefits of lowered costs of search, screen, and price discovery to emerge while simultaneously spreading the costs of its services over a sufficient base of users (Rashid, Winter-Nelson & Garcia, 2010). First, the commodities to be traded on the exchange must have certain physical and market features. Without such standardized commodities, an exchange can quickly become irrelevant (Rashid et al., 2010).

Initial commodities markets were developed solely for storable commodities such as cereals, coffee, cotton, and metals. However, with innovations in refrigeration, many commodities such as orange juice concentrate and pork bellies that were previously un-storable are now able to be traded in commodities exchanges. These commodities tradable though the same, they can differ in terms of moisture, impurities, safety standards, amongst other features. For a commodity to be tradable in a futures market, it must be subject to grades and standards that account for relevant attributes (Rashid et al., 2010).

Many African countries have grades and standards for major export commodities such as cocoa in Ghana. However, they lack formal grades and standards for cereals, and countries may need to develop or improve their systems of grades and standards before setting up exchanges (Rashid et al., 2010). With practical standards, futures contracts can identify specific characteristics and allow for standardized discounts when contract specifications are not met at delivery.

Furthermore given appropriate commodity features, an exchange needs to be supported by an enabling economic and policy environment (Rashid et al., 2010). Commodity exchanges have traditionally been developed under private initiatives, but they require supportive public policies. The benefits of an exchange can be achieved only if a country has the following policies such as adequate infrastructure, efficient flow of information, a sound macroeconomic and financial environment, stable rule of law, and effective contract enforcement in place. A commodity exchange cannot be established and sustained in the absence of sound



policies for monetary management and foreign trade (Rashid et al., 2010). Macroeconomic indicators such as real interest rates, exchange rates and inflation rates needs to stable and reasonably undistorted (Rashid et al., 2010).

Likewise, a successful commodities exchange depends on a developed financial system. For an exchange to operate successfully, there must be an adequate number of potential hedgers and speculators in the economy (Rashid et al., 2010). These individuals must understand risk-taking and trading and must have financial capacity. Moreover, the exchange itself must have access to a clearinghouse with sufficient capital to serve as a guarantor of all transactions (Rashid et al., 2010). These requirements imply a generally well-functioning financial sector.

Also, public policy must support commodity exchange development by desisting from controlling commodity markets and by allowing producer organizations and other entities to emerge as intermediaries between farmers and exchanges (Rashid et al., 2010). Cereals are the most dominant crops in agricultural production in most African countries, and are the likely target for commodity exchanges. These crops are inevitably politically sensitive in low-income countries and are vulnerable to volatile policy intervention, which adds another layer of risk that can limit the success of an exchange (Rashid et al., 2010). For example, in the 1990's Zambia successfully established a commodity exchange after agricultural market liberalization; the government rendered the exchange redundant when it intervened in the maize markets when it was faced with intolerable food price increases in the late 1990's (Rashid et al.,

2010). Interventions from governments if large can destroy the confidence in the market-based system and reduce the likelihood of a successful exchange.

## **2.3 Food production in Ghana**

Onumah (2009) in his report indicated that production of agricultural commodities in Ghana has recorded significant improvement since the late 1990s, with average growth in output rising between 2003-2006 to 5.8% from 3.6% in 1999-2002 (Onumah, 2009). He also noted that average yields for the major agricultural commodities have hardly risen since 2000, implying that the boosted sector growth was chiefly due to extensification of production.

In addition, crops including maize, rice and millet (grains), yam and cassava (starchy staples) amongst others have considerable potential for productivity improvements, which were 60 percent lower than attainable yields (Onumah, 2009). These crops could increase yield over 60 percent if production technology is further improved.

The production of major food and industrial commodities, which accounts for almost 80 percent of GDP, was reported to have stagnated partly as a result of low farm productivity (Onumah, 2009). Increasing output and productivity in the non-cocoa crop sectors of agriculture will significantly reduce poverty amongst non-cocoa growing farmers, particularly in Northern Ghana (Onumah, 2009).

Farm productivity has to be improved through measures such as modernizing the country's agricultural marketing systems; aside the adoption of improved production technology such as planting high-yielding varieties and improved access to farm extension and finance (Onumah, 2009).

Further literary works by Denise Wolter in 2008 reinforces the claim that Ghana's current food production is low and must improve yields to fully enjoy the benefits of the commodities exchange. According to Wolter, Ghana continues to face food security problems due to deteriorating productivity in the food crop sector and undeveloped internal food markets especially in northern Ghana (Wolter, 2008). Efforts should be made to increase crop yield in order to take advantage of the growing demand from Ghana's middle-income class develop a local food industry aside resolving food security problems (Wolter, 2008).

It is however puzzling how Ghana has favorable natural conditions for agriculture but remains highly dependent on food imports. According to the Ministry of Food and Agriculture (MoFA), Ghana's agricultural production currently meets only half of domestic cereal and meat needs and 60 per cent of domestic fish consumption (Wolter, 2008). Self-sufficiency is achieved only in starchy staples such as cassava, yam and plantain, while rice and maize production falls far below demand (Wolter, 2008).

The author further elaborated on various reasons why Ghana's food crop production lies below potential yields. These factors in his research include untapped potential in irrigation; Ghana's agriculture is mainly rain-

fed, with conventional systems of farming still dominant in most parts of the country (Wolter, 2008).

Also, poor technology and small production units disallows economies of scale and lead to sub-optimal yields. For instance, maize and rice are produced at a third of their potential yields per hectare due to poor technology and farm inputs (OECD, 2008).

Lastly lack of proper linkages between the farmers and market, in the absence of transport and storage infrastructure, small farmers have hardly any access to local and international markets. Ghana is currently producing less than 30 per cent of the raw materials needed by its agro-based industries (Wolter, 2008). The Government of Ghana has implemented incentives such as tax holidays to encourage food processing, but results have been minimal as holdups such as lack of infrastructure, and finance amongst others remain. As local food processing remains below the potential to meet local demand, high-value food imports have been increasing (Wolter, 2008).

Moreover in Xinshen Diao's paper on Economic Importance of Agriculture to Development in Ghana (2010), discusses yields of major crops in Ghana. According to him, the actual yields are much lower than the achievable yields for many crops in most zones of Ghana. According to the Ministry of Food and Agriculture data he used, yields for most crops are 20%-60% below their achievable level under existing technologies combined with the use of modern inputs such as fertilizers and improved seeds, which provides an opportunity for agricultural growth. For example from Table 1 below, the achievable yields of Maize and Yam are 2.5 Mt/ha

and 20 Mt/ha respectively, however the average yields for the period between 1990-2006 were 1.5 Mt/ha and 12.4 Mt/ha, leading to gap yields of 40 percent for Maize and 38 percent for Yam. He based the gap in yields on poor farming systems and practices as well as poor marketing strategies.

**Table 1: Yield Gaps in Ghana (1990-2006)**

Crop	Average yields (1990-2006) Mt/ha	Achievable yields (Mt/ha)	Yield gap (Mt/ha)	Yield gap (%)
Maize	1.5	2.5	1.0	40.0
Rice	2.1	3.5	1.4	40.0
Millet	0.8	1.5	0.7	46.7
Sorghum	1.0	1.5	0.5	33.3
Cassava	11.9	28.0	16.1	57.5
Cocoyam	6.7	8.0	1.3	16.3
Yam	12.4	20.0	7.6	38.0
Plantain	8.1	10.0	1.9	19.0
Sweet Potato	8.5	18.0	9.5	52.8
Cowpea	1.0	1.3	0.3	23.1
Groundnut	0.8	1.0	0.2	20.0
Soybean	0.8	1.0	0.2	20.0
Cocoa	0.4	1.0	0.6	60.0

*Note:* According to MOFA's definition, achievable yields are derived from on farm observations, where recommended technologies have been used together with more effective extension services.  
*Source:* Ministry of Food and Agriculture (MOFA) 2007.

Diao also mentioned that without improvement in domestic food production, import demand for goods such as rice and poultry would increase from 60% and 90% respectively (Diao, 2010). Ghanaian households spend about 40 to 50 percent of incomes on food; demand from the local market is expected to further grow with income and population growth and the process of urbanization (Diao et al. 2007). This presents an opportunity for growth in the agricultural sector, if competitiveness of local food produce is enhanced through modern technology (Diao, 2010). The author also acknowledged that there has been some growth in crop production, however this growth has largely been the result of land expansion, together with modest improvement in crop yields. Additional growth in Ghana's agricultural sector requires more

sustainable growth sources other than land expansion, measures such as productivity-led and high-value-led agricultural growth should be emphasized as they are means to transforming Ghana's agricultural sector (Diao, 2010).

### **2.3 Warehousing Storage Facilities (Warehousing)**

Coulter and Onumah (2002) stated that after decades of agricultural reforms, agricultural markets remain underdeveloped and inefficient. They went further in their studies to discuss the development of accessible warehouse receipt systems (WRS) as a means of improving the performance of agricultural markets in Africa, which will consequently enhance rural livelihoods (Coulter & Onumah, 2002).

Additionally, some problems such as poor storage and transport infrastructure in food markets, limited access to commodity finance, risk due to unstable marketing margins, risk of theft and storage losses, amongst others identified prohibit agricultural market development (Coulter & Onumah, 2002). These markets also lack institutions and instruments to manage price and other risks. Systems of standard grades and measures are poorly developed, except for a few export crops, making it difficult for more efficient trade to develop. The markets lack transparent systems of price discovery (Coulter & Onumah, 2002).

These problems faced particularly by smallholders, dampen production incentives, and add to stagnation in agricultural output and productivity. High food price variability makes poor consumers in urban and deficit-producing rural areas prone to food insecurity (Coulter & Onumah, 2002). Improving the performance of agricultural markets will,

therefore, enhance the livelihoods of the rural and urban poor, but in many adjusting African economies this is yet to be achieved (Coulter & Onumah, 2002).

Onumah (2010) in his paper implementing Warehousing Receipts systems in Africa examined the development of warehouse receipt systems (WRS) as an important means of improving the performance of agricultural marketing systems in Africa following liberalization in the 1980s (Onumah, 2010).

Lack of well-organized storage infrastructure was a major cause for the very high levels of postharvest losses estimated at 30 percent in Africa (Onumah, 2010). A recent study questioned this estimate and projected that postharvest losses in the grain sector in Sub-Saharan Africa (SSA) was US \$4 billion per year and this loss could be avoided with a proper Warehousing system (Onumah, 2010). Interestingly from the study, the annual value of grain losses parallels the total value of cereal imports, an indication that reducing postharvest losses offers a cost-effective means to improve food availability.

According to him, the advancement in promoting WRS and related market institutions in Africa has generally been limited. He however noted that interest remains high particularly in Eastern, Southern Africa and other parts of Africa. He noted in his essay that Uganda is expanding its WRS, especially for grains, to ensure increased trading activities by its commodity exchange (Onumah, 2010). Tanzania on the other hand plans to strengthen its warehouse regulatory regime in order to ensure that receipting can be promoted for staple grains as it has been done for

export crops such as coffee, cotton and cashew (Onumah, 2010).

The Warehouse Receipt System (WRS) is seen as crucial factor in ensuring the viability of a commodity exchange. According to the research paper in Zambia, stakeholders are encouraging warehouse legislation in order to boost confidence in the receipt system, while investing in rural accumulation infrastructure to expand scope for smallholder access to the receipt system (Onumah, 2010).

It is obvious from the above that expectations that a WRS can be a strategically important part of efforts to transform agricultural marketing systems in Africa persist. It is also argued in the paper these expectations are not misplaced and this was illustrated with substantiation from successful WRS pilots in Eastern and Southern Africa (ESA) on how it can help in addressing some of the factors contributing to the inadequacy in agricultural commodity trade (Onumah, 2010).

In conclusion, the various essays explained extensively the poor current level of food production and inadequacy of storage facilities. They also stipulated measures Ghana can employ in order for Ghana to have a thriving and economically beneficial commodities exchange. The requirements such as improved crop yields and efficient warehousing systems, which are currently lacking from the above discussed research papers.



## **Chapter 3: Methodology**

### **3.1 Introduction**

In the quest to establish the feasibility of the commodities exchange in Ghana, it was necessary to find suitable data, which upon an analysis of such data informed the conclusions, and recommendations that could be made. Based on the findings from the literature review, it was vital to collect both primary and secondary data for the study to answer the research questions posed adequately.

This chapter explains research design and tools employed and data collection methods used during the collection process. It involves the types of data to be collected, the sources, sample sizes and interview guide design. In addition, it highlights the possible limitations encountered during data collection.

### **3.2 Research Design**

The research design stipulates the general plan of how the research questions will be answered. The design was chosen based on the research questions and objectives. In order to adequately answer the questions and satisfy the purpose of the study, both the descriptive and exploratory designs were employed. The descriptive study served as a forerunner to the exploratory study. This is because it was necessary to have a clear picture of the phenomena on which the researcher wished to collect data on prior to the collection of data (Saunders et al., 2007).

An exploratory study gave more insight into the topic by clarifying the problem. That is if the current crop production levels and warehousing facilities are adequate to support the commencement of the exchange.

This research was conducted using scholarly literature and the survey strategy due to its descriptive and exploratory nature. Surveys allow the collection of data from a sizeable population economically.

Information was obtained by administering standardized questions to the key stakeholders experts involved in the establishment of the GCX. These experts included the following:

- ❖ Mr. Robert Owoo of Securities and Exchange Commission (SEC);
- ❖ Mr. Nasir Yartey of Ministry of Trade and Industry (MoTI);
- ❖ Beatrice Esses of the National Food and Buffer Stock Company (NAFCO); and
- ❖ Mr. Sam Okang-Boye of Ghana Grains Council (GGC)

Interviews conducted with representatives from the various institutions were to ascertain:

- ❖ Crops being selected for GCX trading,
- ❖ Selection criteria
- ❖ Yield of crops
- ❖ Yield requirement for the commencement of the GCX
- ❖ Sufficiency of yields to meet GCX requirement
- ❖ Storage facilities availability
- ❖ Storage capacity
- ❖ Location,
- ❖ Adequacy of facilities
- ❖ Conditions of facilities

The survey made it possible to collect quantitative data, which was analyzed quantitatively using descriptive statistics.

### **3.3 Data Source**

This research used a combination of primary and secondary data sources. Primary sources include structured and semi-structured questions administered in interviews with experts in organizations such as the NAFCO, GGC, SEC and MoTI.

Secondary data on the other hand, included data on warehousing capacities in Ghana, warehousing receipts system (WRS), and food production levels amongst others was available in books, journal articles and newspapers available on the Internet (World Wide Web) and in the Library or recommended by experts in the field.

### **3.4 Area of Study**

As stipulated earlier, the research required the collection of primary data from the study population of experts in organizations such as the Ministry of Trade and Industry, NAFCO, and Commission in charge of setting up the exchange. Since these bodies are located in Accra, it was required to focus data collection in Accra.

### **3.5 Sampling Methods**

Based on subjective judgement, the appropriate sampling technique that used was the non-probabilistic sampling method based on the research questions and objectives (Saunders et al., 2007). Specifically purposive or judgemental sampling, allowed the researcher to use personal judgement to select experts that best answered the research questions and met the objectives.

However, it was also supported with snowballing, where identified experts recommended others they deemed would make constructive

contributions to the research questions and meet the objectives (Saunders et al., 2007).

These experts had in-depth understanding of the commodity exchange system and its operations, and as such their opinions were very relevant to answering the question whether the current food production levels and storage facilities currently available are adequate to set up the exchange in Ghana.

### **3.6 Research Instruments Or Data Collection Tools/Instruments**

As mentioned previously, personal interviews were used as instruments to collect data from the sample respondents. The use of personal interview enabled the researcher to gather valid and reliable data that was relevant to the research questions and objectives. Interviews took the form of both structured and semi-structured (Saunders et al., 2007). Structured interviews used questionnaires based on standardised set of questions.

Whereas in the case of semi-structured interviews, there was a list of questions covered and differed from interview to interview, given a specific organisational context. Also, additional questions to explore the research question were asked.

The information was recorded by note taking. These sessions were done on a one-to-one basis that is face-to-face. However telephone interviews used depending on the availability of the respondent.

### **3.7 Data Analysis Tools**

Owing to the data collection tools to be employed and the qualitative nature of the research, it was appropriate to use Computer aided qualitative data analysis (CAQDAS) programs to export statistical analysis such as Microsoft Office Excel to display frequencies (Saunders et al., 2007). CAQDAS increases the transparency and methodological rigour of the research findings. Responses were tabulated and graphed in Excel for better presentation and analysis (Saunders et al., 2007).

### **3.8 Challenges Of The Study**

Some challenges encountered during data collection includes:

- Unwillingness of some representatives to give out some information due to their sensitive nature
- Time allocated for the interviews was not compatible to some respondents
- Monetary constraints as this study is not a funded research
- Unavailability of data on some crops to be traded on the exchange

## **Chapter 4: Data Findings and Analysis**

### **4.1 Introduction**

The purpose of this study is to investigate whether Ghana's current food production level and available warehousing facilities is adequate to support the efficient running of the Ghana Commodities Exchange.

In order to achieve this purpose, the following specific research objectives and questions had to be answered.

#### Specific Objectives:

- ❖ To find out whether the current yield is adequate and will be able to support the commencement of the GCX
- ❖ To determine whether the available warehousing system is adequate and would support the commencement of the GCX

#### Research Questions:

- ❖ Are the current yields of crops adequate and will it be able to support the GCX's commencement?
- ❖ Are the available warehousing facilities adequate and would it support the commencement of the GCX?

To answer the research questions and satisfy research objectives adequately, the researcher gathered primary data by interviewing experts directly involved with the establishment of the commodities exchange.

They include representatives from:

- Ministry of Trade and Industry (MOTI)
- National Food Buffer Stock Company (NAFCO)
- Securities and Exchange Commission (SEC)
- Ghana Stock Exchange (GSE) and

- Ghana Grains Council (GGC)

All findings in the research are based on responses of the representatives of the institutions involved with the establishment of the exchange as well as data collected from secondary sources.

The findings of the research mainly answered the first and second research questions.

#### **4.2 Adequacy of crop yield to support the GCX's commencement**

Table 2 summarizes the list of crops to be receipted and traded on the exchange when it commences business.

The commodities are labeled under potential for receipting and trading. Under these labels, the crops are categorized under high, moderate or low depending upon its potentiality in receipting and trading.

**Table 2: Commodities for receipting and trading on the GCX**

Commodity	Average annual output (tones)	Potential for receipting	Potential for exchange trading
Maize	1,190,000	High	High
Sorghum	297,000	High	Moderate
Rice (paddy)	257,000	High	High
Millet	170,000	Low	Low
Cassava flour	-	High	High
Yam	3,878,000	Low	Moderate
Groundnuts	450,000	High	High
Sheanuts	250,000	High	High
Palm Oil	100,000	High	Low
Coffee	3000	Low	High
Cocoa	740,000	High	High (domestic)
Seed cotton	-	High	High
Frozen fish	-	High	Moderate
Natural rubber	-	High	Low
Soybeans	49,000	High	High
Fruit juice concentrate	-	Moderate	Moderate

Commodities with high potential for receipting and trading are the main crops to be traded on the exchange. According to a feasibility study

conducted by the Natural Resource Institute (NRI), the selection criteria is based on:

- ❖ Volumes traded in the formal market (domestic, regional and international)
- ❖ Farm gate and/or wholesale price trends and potential impact on incentives for deferred sale.
- ❖ Existing supply chain and amenability to introduction of new marketing and financing instruments/institutions (including key players, embedded practices and constraints).
- ❖ Existing or easy adaptation of international grading standards for the identified commodities.
- ❖ Experience in receipting/collateralization of the commodity.
- ❖ Business and other risks (including policy-related risks) which can discourage use of new marketing and financing instruments by key players.

Thus, the major crops being considered for the exchange include maize, sorghum, paddy rice, cassava flour, groundnuts, sheanuts, palm oil, cotton lint, frozen fish, Soybeans and domestic market cocoa.

It is anticipated that trading in maize will be boosted by the feedstock industry, particularly the poultry feed chain. GAFCO, a major flourmill and feedstock producer at Tema has an annual demand at about 15,000 tonnes of maize and has indicated interest in utilizing the exchange to procure maize. This 15,000 tonnes represents 30 percent of projected volume of maize to be traded (Natural Resource Institute, 2009).



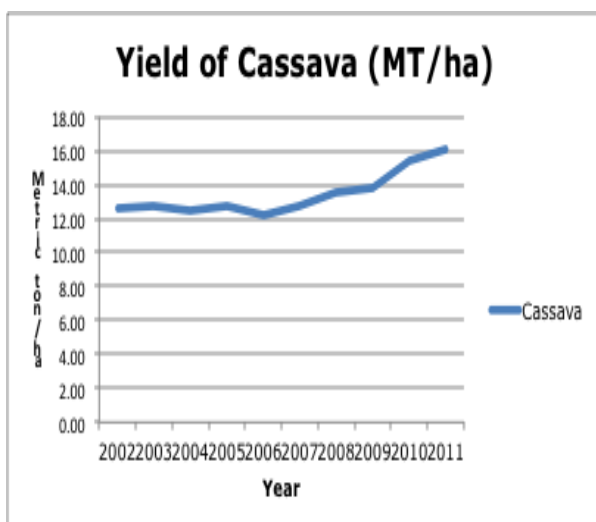
It is notable that Sorghum does not have a high potential for trading but is still been considered for the exchange. The beverage industry particularly Guinness Ghana has high utilization for sorghum in the making beverage alcoholic beverages.

In addition, palm oil with seasonal supply and price variations create high prospects for receipting palm oil, however there are relatively few buyers, and this can limit competitive trading through the exchange. Though it has few buyers, its demand is high and profitable thus its inclusion in the list of exchange commodities (Natural Resource Institute, 2009).

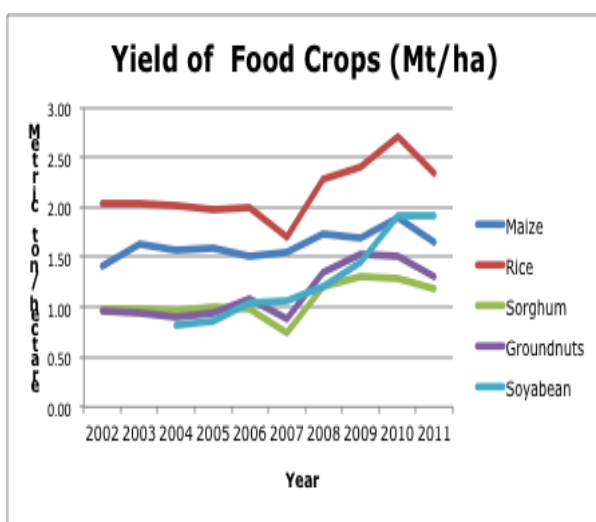
Sam Okang Boye of the Ghana Grains Council (GGC) stated that other major staples such as Yam, and Plantain amongst others are not being considered due to their low life span and price variability.

**Table 3: Yield of major food crops (Mt/Ha)**

Crop	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Maize	1.41	1.63	1.58	1.58	1.50	1.54	1.74	1.70	1.89	1.65
Rice	2.04	2.03	2.03	1.97	1.99	1.70	2.27	2.41	2.71	2.35
Sorghum	0.98	0.98	0.96	1.00	0.98	0.74	1.20	1.31	1.28	1.18
Cassava	12.63	12.68	12.42	12.76	12.20	12.76	13.51	13.84	15.43	16.01
Groundnuts	0.97	0.94	0.90	0.93	1.08	0.88	1.34	1.54	1.50	1.30
Soyabean			0.81	0.86	1.04	1.06	1.21	1.46	1.91	1.91



**Graph 1: Yield of Cassava**



**Graph 2: Yield of other crops**

There are about twelve crops to be traded on the GCX, however due to inavailability of data on some crops, only six crops are being discussed in this section in order to make findings and analysis accurate.

Table 3 shows the yield of the crops from 2002 to 2011 in metric ton per hectare. From the table, it can be deduced that the yields of the crops fluctuate. For instance looking at the behavior of maize, it has shown inconsistency from 2002 to 2011. According to Beatrice Esses of NAFCO and Sam Okang Boye of GGC, these fluctuations can be blamed on

unfavorable weather conditions, inadequate farm inputs, poor farming systems and inaccessibility of funds by farmers. These comments confirm literature as discussed by Denise Wolter and Xinshen Diao that yields of crops are poor due to absence of technology, poor farm inputs, infrastructure, funds and weather conditions.

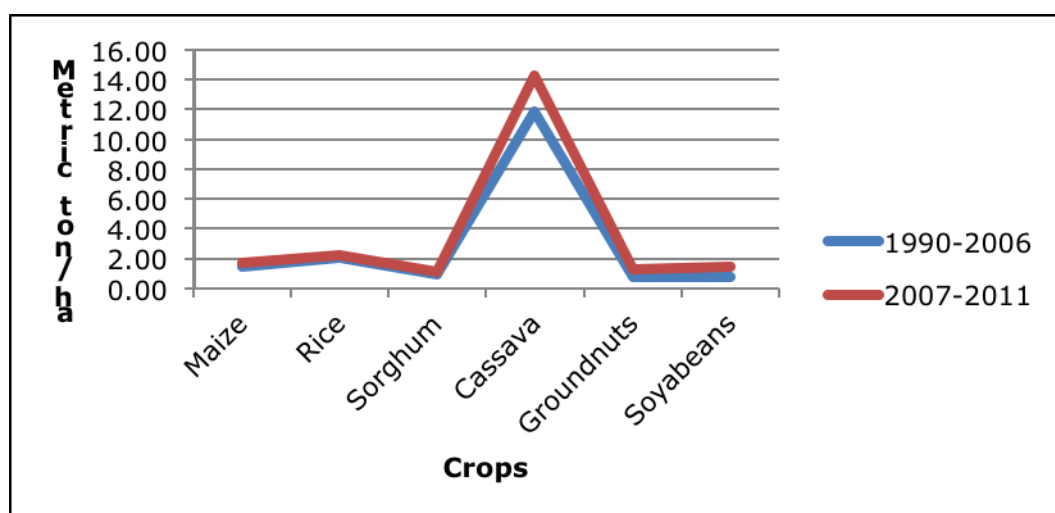
Graph 1 shows the yield of cassava and Graph 2 shows the yields of maize, sorghum, groundnuts, rice and soyabean. These graphs demonstrate that the yield of cassava as compared to the other crops is higher. This high level is attributed to the efforts of the government and private bodies to improve cassava productivity. For instance, the \$145 million joint project between the Government, the World Bank, and USAID over a period of five years to enhance cassava farming (Monitor Group, 2012). Cassava production has been enhanced because further research has revealed more economic beneficial uses of cassava such as instant noodles and pastas, seasoning cubes and mosquito coil production amongst others (Monitor Group, 2012).

#### **4.3 Comparing 1990 to 2006 yields to 2007 to 2011 yields**

Xinshen Diao's paper on Economic Importance of Agriculture to Development in Ghana (2010) as used in the literature review examined the yields of major crops in Ghana. According to his research, the yields of crops are 20 percent to 60 percent lower than their achievable level from 1990 to 2006 (Diao, 2010). However research findings from 2007 to 2011 in Graph 3, these yields have improved significantly

Mr. Yartey from the Ministry of Trade and Industry (MOTI) mentioned that higher yields were achievable due to the use of modern

inputs such as fertilizers, improved seedlings, superior farming practices and technology.



**Graph 3: 1990 to 2006 Crop Yields against 2007 to 2011 Yields**

For example from table 1 in chapter 2, the yield of Cassava has grown steadily from the average of 11.9 Mt/ha (i.e. 1990 – 2006) to the yield of 16.01 Mt/ha in 2011 evident in table 3. Mr. Yartey stated that with continuous improved farming inputs and technology, the yield would reach its achievable yield of 28.0 Mt/ha by 2020.

Graph 3 compares the averaged yields of maize, rice, sorghum, cassava, groundnuts and soya beans from 1990 to 2006 as researched by Mr. Diao in literature against research findings provided by the NAFCO.

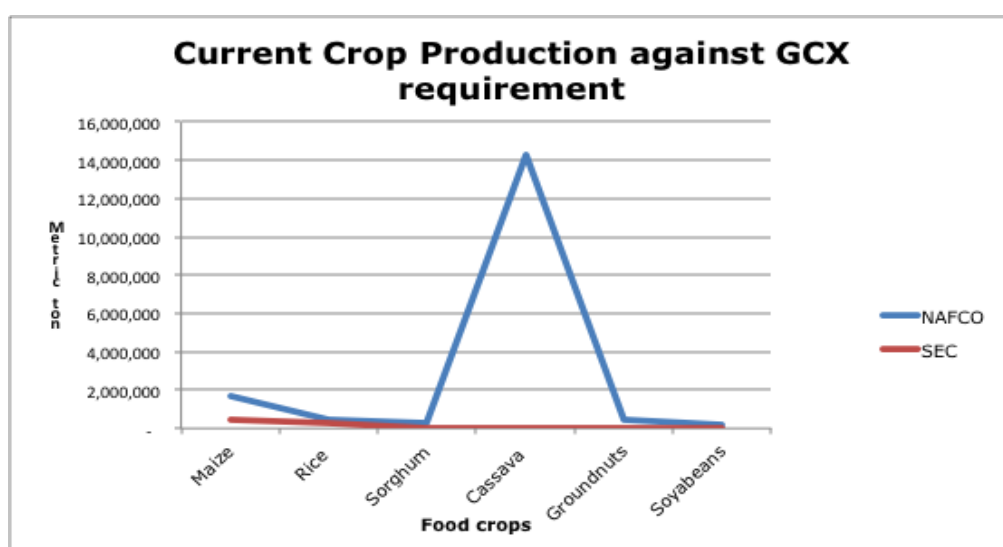
The graph depicts that the yields of the crops under review have improved from when Diao wrote his paper. This improvement according to all respondents is due to better-quality technology such as high yielding varieties of crops, access to finance, improved irrigation, and modern farm inputs amongst others.

#### 4.4 Comparing NAFCO production levels to the SEC study production levels needed for the commencement of the exchange

The current production of crops in Metric Tonnes (Mt) as at 2011 complied by National Food Buffer Stock Company (NAFCO) is exhibited in table 3 column 1. Also, the feasibility study on the establishment of the commodities exchange done by the Securities and Exchange Commission (SEC) is represented in column 2 in table 3. The figures are the summation of projected crops to be traded over the period of five years as complied by the researchers.

**Table 4: Production volumes of major exchange crops (Metric Tonnes)**

Commodity	NAFCO	SEC
Maize	1,683,984	415,000
Rice	463,975	285,000
Sorghum	287,069	50,000
Cassava	14,240,867	18,500
Groundnuts	465,103	5,000
Soya beans	164,511	11,500



**Graph 4: Current Food production against GCX 5 year requirement**

Comparing the NAFCO estimates to the SEC's, it shows that production of crops, particularly tradable crops on the exchange as at 2011 surpasses the sum of the volumes estimated to trade on the exchange over a period of five years.

Beatrice Esses explained that Ghana has over the years significantly increased crop production through means such improved seedlings, easy accessibility to funds, technological machines, proper farming practices and increased demand of food.

When asked if the current levels of crop production is sufficient for the commencement of the exchange, all experts responded positively and this is further supported by the figures in Table 4. This is further visualized in graph 4, which shows that the food production as at 2011 is higher than the GCX five-year requirement to establish the exchange.

#### **4.5: Adequate warehouses located in Ghana and storage capacity of the warehouses**

To achieve the objective of establishing whether the available warehousing system will enhance trading when the exchange commences satisfactorily, the researcher sought to find data on the available storage facilities available, their capacity and conditions.

According to Mr. Robert Owoo of the Securities and Exchange Commission (SEC), the Natural Resource Institute on behalf of SEC carried out a study. The study surveyed warehouses and silos for the

establishment of commodities exchange and Warehouse Receipt System (WRS) in Ghana.

The survey involved on-site assessment of storage facilities (warehouses and silos) in the major cities, towns and market centers in Ghana where there is considerable activity in commodity trade and storage. The focal areas of the survey include: Accra-Tema, Kumasi, Takoradi/Tarkwa, and Techiman/Sunyani. These warehouses and silos in the country were estimated to have storage capacity over 1.3 million tonnes (Natural Resource Institute, 2008).

**Table 5: Warehousing capacity in major cities/towns in Ghana (2008)**

City/town	Estimated warehousing capacity (tonnes)	Share of total capacity (%)
Accra	902,000	68.6
Tema	232,400	17.7
Kumasi	133,000	10.1
Takoradi	27,600	2.1
Sunyani/Techiman	20,000	1.5
Total	1,315,000	100

As portrayed in Table 5, there is a concentration of warehousing facilities in the Accra/Tema area, because of imports and exports trade. Cocoa accounts for about 65 percent of the total storage space whereas agricultural commodities and agricultural surpluses accounts for 8.4 percent and 1.5 percent of the available capacity respectively (Natural Resource Institute, 2008).

Thus, the available capacity for storing agricultural commodities will be tragically inadequate for the needs of the proposed commodities exchange when it commences trading.

According to Mr. Sam Okang Boye of Ghana Grains Council, due to the low number and defunct warehouses owned by the state, organizations in the private sector have also constructed warehouses in the various parts of the country close to the farmers to help them store their crops and reduce post harvest losses. Table 6 lists these private sector owners and the capacity of their warehouses.

**Table 6: Total Capacity of Warehousing capacity**

<b>Owners</b>	<b>Total Capacity (Mt)</b>
Alfedos Co. Ltd	75,000
Wienco	28,000
GFDC	23,500
NAFCO	10,000
MIDA	10,000
3G&T Ltd	3,000
Nasia	2,000
Pure Company	2,000
USAID &AGRA	1,440
FASCOM	1,000
CDH	1,000
Ghana Cotton Company	300
Green Leaders	350
Technoserve	100



#### **4.6 Assessing the conditions of available warehouses in Ghana**

Mr. Okang Boye mentioned in his interview that the conditions of the warehouses are far from meeting the standards; especially the government owned warehouses and described the state of the privately owned warehouses to be average.

The survey of warehouses and silos for establishment of commodities exchange and warehouse receipt system (WRS) in Ghana carried out by NRI on the behalf of SEC observed that a common problem the warehouses had was inadequate ventilation. In over 60 percent of the warehouses surveyed, security walls/fencing was absent. In addition, they lacked fire safety equipment.

Moreover, management standards in the country are variable. For instance, in Kumasi only 21% of the surveyed warehouses were classified as good while 50% were below average. In Accra-Tema, only 14% of the warehouses surveyed were classified as good, while a very high 53% were below average (Natural Resource Institute, 2008).

Likewise it was noted that the standard of hygiene and cleanliness was generally poor with varying degrees of spillage and accumulated rubbish on floors.

Lack of skilled personnel was another major problem noted. For example warehouses surveyed in Accra-Tema and Kumasi 48% and 21% respectively were manned by inadequate staff, many of whom lacked professional skills in storage management and the handling of especially agricultural commodities in a manner that minimizes the risk of quality deterioration (Natural Resource Institute, 2008).

The credibility and therefore viability of the WRS and exchange trading in the country, according to Mr. Boye, depends very much on raising these standards to levels that will assure lenders and depositors that collateralized stocks are secure.

These findings confirm what scholars like Coulter and Onumah identified in literature that Ghana's warehousing facilities are underdeveloped, defunct and in poor conditions.

## **Chapter 5: Recommendations and Conclusions**

This concluding chapter of the study proposes measures that may be adopted to improve crop yields and warehouse capacities in the country in order for the GCX to run efficiently. It also summarizes research findings.

### **5.1: Recommendations**

This study sought to determine whether the current food production levels and warehousing facilities available would support the exchange when it commences business. This concluding chapter makes some recommendations as to what can be done to enhance these vital aspects of the exchange to make it worthwhile.

From data analysis and discussion, the researcher recommends the following to the National Technical Committee set up by the government to oversee the establishment of the Ghana Commodities Exchange.

Recommendations below particularly addresses the deficiencies identified in the warehousing industry in the country, which pose a significant threat to the development of a credible WRS that will support a viable commodities exchange. Government or the private sector due to the dearth of warehousing should build warehouses and silos in the rural farming areas and other infrastructure in food surplus producing areas of the country could constrain beginning of the project.

The Government should promote private investment in silos and warehouses along the railway network and Volta River systems. Government can foster this through offering attractive tax incentives as well as facilitating procurement of land by investors.

In addition, investment in warehousing and silo facilities in Techiman, Ejura and Tamale needs to be encouraged. These are major

produce markets for most of the focal commodities and are easily accessible to southern and regional consumer markets, making it relatively easy to determine any locational discounts for traded commodities.

From the crop production perspective, data shows that crop production has improved over the years. This improvement is attributed to the governmental efforts such as involving the youth in food production and processing, introduction of technology, modernized farm inputs and availability of funds to farmers.

From data analysis, Cassava has the highest yield in the country amongst the crops being considered for the Ghana Commodities Exchange (GCX). It is a global staple food with numerous benefits. For instance in 2006, it contributed 22 percent of Agricultural GDP of the country (Monitor Group, 2012). High Quality Cassava Flour (HQCF) and its derivatives can be used in the bread production, instant noodles and pastas, seasoning cubes, mosquito coil production, textile production (i.e. yarn and cloth), glue for plywood production and local food preparation amongst others. The improvement should be extended to the other crops to be traded on the exchange so that they also contribute more to Agricultural GDP.

The government and private organizations in the medium to long term will require substantial productivity enhancing investments, including rural infrastructure, irrigation, marketing, extension, and agricultural research and development (R&D) in order to modernize food crop production.

## **5.2 Conclusions**

Since the 1980s, Ghana has liberalised agricultural markets since the 1980s. Its outcome has been rather unsatisfactory especially for the domestic agricultural trade. The markets remain under-developed and inefficient, lacking adequate storage and transport infrastructure and strong supporting institutions and instruments that enable producers to manage marketing and price risks.

They are characterised by wide distribution margins and very high seasonal supply and price variability. High transaction costs, imperfect information and incomplete markets contribute to inefficiency in agricultural markets in Africa, implying the need for strong non-market institutions to promote fluid and efficient exchange to also limit post harvest losses.

For instance a study by Gideon Onumah (2010) estimated that postharvest losses of USD 4 billion per year could be avoided with a proper warehousing system.

The research findings adequately answered research questions and met objectives satisfactorily. From data analysis and results, Ghana's current crop yield is adequate and will be able to support commencement of the exchange. These findings also revealed that indeed Ghana's yield was poor in the past, but has improved significantly in the late 2000's.

The second objective also revealed that indeed Ghana lacks the satisfactory warehousing infrastructure facilities to support the commodities exchange. For instance, in Kumasi only 21% of the surveyed warehouses were classified as good while 50% were below average. In Accra-Tema, only 14% of the warehouses surveyed were classified as good, while a very

high 53% were below average (SEC, 2008). Also, interview respondents cited that though there are deficiencies in the warehousing aspect, Ghana could still go ahead and commence the GCX due to private institutions such as Technoserve, USAID&AGRA, and MIDA amongst others who have taken up the initiative to construct warehouses in surplus producing areas.

It is within this framework that this paper proposes that food crop production should be improved and more quality warehouses be constructed to enhance GCX trade.

It was reviewed that marketing for a range of commodities in Ghana and established that the formation of a commodities exchange and supporting warehouse receipt system (WRS) in the country will help transform commodity marketing in the country as well as significantly improve management of post-harvest risks in some of the commodity sectors.

From analysis, it is feasible to develop the proposed GCX model in Ghana because the fundamental physical and institutional structures as well as required services are available. Further investment is required in, especially, physical warehouse infrastructure in surplus-producing and in improving the institutional infrastructure for delivery of market information, quality and quantity assurance, sustained building of the capacity of key players and fast, low-cost resolution of trade disputes.

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## **Appendix**

### **Introduction**

In order to fulfill the aim of the research, primary data has to be collected from experts in the various institutional bodies. The primary data collection tools employed is personal interviews, which will need structured and semi-structured questions to ensure that the researcher stays on course and fulfills the aims of the paper. These questions were formulated bearing in mind the research questions and objectives

### **Sample Questions for the Interview**

#### **Research Objective**

To find out whether the current food production level and available warehousing facilities are adequate to support the establishment of the Ghana Commodities Exchange.

#### **Research Question 1**

**Is the current yield of crops adequate and will it be able to support the GCX when it commences trading?**

#### **Questions**

1. What crops are going to be traded?
2. Current yield of these crops?
3. What levels are desired yields needed for trading in an exchange?

4. Are these levels sufficient?
5. If not what, what measures are being undertaken to increase yield?
6. How are farmers being equipped to increase production?
7. Why are yields low?

## **Research Question 2**

### **Will the available warehousing system enhance trading when the exchange commences?**

1. How many warehouses are located in Ghana?
2. What is the storage capacity of these warehouses?
3. How many of these warehouses have the storage capacity to store agricultural produce for local consumption?
4. What is the condition of these warehouses? (i.e. adequate lighting, necessary temperature for agricultural storage, security)
5. What steps can be taken to enhance the efficiency of the commodity exchange system?
6. Would improved warehousing facilities encourage more Ghanaians to farm?
7. How so if it would?