KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,

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DEPARTMENT OF HORTICULTURE

EFFECT OF STORAGE AND TRANSPORTATION CHALLENGES OF LBCS ON THE QUALITY AND POSTHARVEST LOSSES OF COCOA BEANS FROM ENCHI A, ENCHI B AND SEFWI WIAWSO COCOA DISTRICTS IN THE WESTERN REGION OF GHANA.

BY

EMMANUEL BENIE ASANTE

JANUARY, 2014.

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A THESIS SUBMITTED TO THE SCHOOL OF RESEARCH AND GRADUEATE STUDIES, KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, IN PARTIAL FUFILMENT OF THE REQUIREMENT FOR THE AWARD OF

MASTERS OF PHILOSOPHY

(MPhil POSTHARVEST TECHNOLOGY) DEGREE

BY

EMMANUEL BENIE ASANTE (BSc AGRICULTURE)

JANUARY, 2014

DECLARATION

I do hereby declare that except for references and quotations which have been duly acknowledged, this is a research carried out by me under the supervision of Mr. Patrick Kumah Lecturer of the Department of Horticulture, Kwame Nkrumah University of Science and Technology. This work has not been submitted in whole or in part for a degree anywhere.

I am therefore solely responsible for any shortcomings, marginal or substantial which may be found in this work.

Signature…… **……**

EMMANUEL BENIE ASANTE **DATE**

(Student)

…… **……**

MR. PATRICK KUMAH **DATE**

(Supervisor)

Signature……. **…….**

DR BEN K. BANFUL **DATE**

(Head of Department)

ABSTRACT

Cocoa is Ghana's main export crop and the country is renowned for its quality cocoa beans leading to a priced premium on the international market. Government involvement through Quality Control Company (QCC) of Ghana Cocoa Board (COCOBOD) has provided the necessary quality assurance for the local and external markets. Cocoa quality checks at the farm gate, buying centers at the village level and Take-Over Centres (TOCs) for storage and subsequently export has helped to maintain produce quality. Notwithstanding the good reputation of Ghana's cocoa and the efforts made by COCOBOD to maintain quality, there are indications that quality can be compromised in the face of market liberalization. This study aimed at assessing the various challenges associated with the storage and transportation of cocoa by the LBCs in Enchi A, Enchi B and Sefwi Wiawso Cocoa Districts in the Western Region of Ghana and how these challenges affected cocoa quality and losses. One hundred and fifty Depots(50 depots from each district) were randomly selected through multi stage sampling procedure which included purposive and simple random sampling techniques and their Depot Keepers or District Officers were interviewed. Samples of cocoa beans were also drawn from the selected depots and analyzed per the quality standards of Ghana's Cocoa industry Regulation (Consolidated) Decree 1968. Results were analyzed with SPSS version 17. A chi-Square test (value of 1.5762) performed on the forms of storage losses (Mould, insect infestations, theft) showed that, such losses significantly ($p \leq 0.002$) contributed to the losses in storage in all the three cocoa Districts. Additionally, a Chi-square test (value of 1.4365), performed on rejections due to transportation challenges for the three cocoa districts showed that the identified defects due to transportation

challenges (rain-wet bags, dirty sacks, oil stain sacks, torn/burst sacks and weight loss) significantly ($p \leq 0.005$) contributed the rejections at the port. The study revealed that, storage procedures and transportation processes and the various challenges identified, influenced the percentage of cocoa beans rejected at the Take-Over Centre. The significant difference (0.21 at 95% confidence level) between the field and laboratory work (analyzed cocoa samples from depots) and the Takoradi port records on cocoa rejections showed that the various challenges affecting cocoa in storage; insect infestation, moudiness, and rodents attacks and transportation challenges such as rain-wet of cocoa in transit, dirty, torn bags together with poor roads as identified in the research study played a significant role in losses of cocoa beans. From the study, estimated losses due to the identified storage and transportation challenges by the LBCs in the Sefwi Wiawso cocoa district was 2,490 tonnes (39,840 Bags) valued at Gh¢354,548.55 for the 2011/2012 cocoa season, followed by Enchi A with a loss of 2625.7 tonnes (42,011.2 Bags) valued at Gh¢ 305,122.39 and then Enchi B cocoa district losing 2353.4 tonnes of cocoa (37654.4 Bags) valued at Gh¢278,980.84.To this end, it could be said that addressing the identified storage and the transportation challenges these three cocoa districts alone could increase Ghana's cocoa output by about 7,469 tonnes per season.

DEDICATION

I dedicate this work to my dear father Mr. Matthew Asante, a retired educationist of the Ghana Education Service (Assistant Director 11), Enchi, my uncle Mr. Emmanuel Twumasi Asante, Suaman-Dadieso, my lovely Mother, Mrs. Agnes Quason a teacher of New Yakasi D/C primary School, Enchi and my siblings for the relentless and keen interest demonstrated by them towards my education.

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May God Bless you all.

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LIST OF ABBREVIATIONS

COCOBOD	Ghana Cocoa Board
CMC	Cocoa Marketing Company
CMB	Cocoa Marketing Board
CSSVD	Cocoa Swollen Shoot Virus Disease
CSSVD-CU	Cocoa Swollen Shoot Virus Disease and Control Unit
CTO	Cocoa Take-Over Receipt
CRIG	Cocoa Research Institute of Ghana
GCFS	Ghana Cocoa Farmers Survey
GAIN	Global Agricultural Information Network
LBCs	Licensed Buying Companies
MC	Marketing Clerk
NTD	Not Thoroughly Dried
SPU	Seed Production Unit
TOCs	Take-Over Centres
QCC	Quality Control Company
NLCD	National Leberation Council Decree
LI	Legislative Instrument

CHAPTER ONE

1.0 INTRODUCTION

Cocoa is Ghana's main export crop and the country is renowned for its quality cocoa beans leading to a price premium on the international market. The crop plays a major role in the national economy in terms of employment, incomes and foreign exchange earnings. Breisinger *et al*., (2008) projected that; the socioeconomic development of Ghana would continue to depend on revenue from cocoa exports.

The cocoa sector has diversely received the most attention from successive governments in an attempt to increase the country's output levels and foreign exchange earnings. Achieving these goal calls for measures to maintain and possibly increase product quality since according to Osei (2007), quality determines the value of a product. There are approximately 1.6 million smallholder farmers and with 3.2 million workforce producing around 700,000 Mt of cocoa. Currently, the annual output of approaching 1million Metric tonnes of dried beans earns around 30% of foreign exchange for the country as a whole (Cooper and Cudjoe, 2012).

Government's involvement through Quality Control Company of COCOBOD has provided the necessary assurance for produce quality for the Internal and External exports. Cocoa quality checks at the farm gate, buying centers at the village level and take-over points for storage and subsequently export has helped to maintain produce quality. Notwithstanding the good reputation of Ghana's cocoa and the efforts to

maintain quality, there are indications that quality can be compromised in the face of market liberalization.

Experts believe that one of the dangers of liberalization is the lowering of product quality due to competition from buyers to consolidate or increase their market share (Anang *et al*., 2011).For instance, during the 1997/98 cocoa season, it was found that pressure from the LBCs in Ghana to obtain cocoa from farmers was giving rise to the sale of some cocoa with high moisture content. This encouraged the development of mould which is one of the most important quality defects of cocoa, and one for which international buyers will discount heavily on the international market. For this reason the Quality Control Company of COCOBOD rejected such cocoa at its take-over centres(TOCs)and prevented the shipment/export of such cocoa . The LBCs incurred losses since such cocoa were downgraded sub- standard and were only paid halve price per bag by COCOBOD (Bank of Ghana, 2003). CMC sells such cocoa to the local mills for the extraction of cocoa butter used in the manufacture of soap and cosmetics.

Therefore, the biggest challenge in maintaining the confidence and trust of buyers of Ghana's cocoa is to ensure consistency in the quality of cocoa that the country exports (Osei, 2007).

Storage, primary and secondary evacuation of cocoa have been a source of concern to LBCs especially during peak seasons of the year. There have been many instances where originally graded and sealed cocoa failed to meet quality standards at the take- over centres (TOCs) and therefore was rejected (Adu, 2007). According to Shepherd and Farolfi (1999), the liberalization of markets has brought in its wake new challenges,

including how to maintain produce quality during storage and transportation in a competitive market environment. Vigneri and Santos (2007) also identified that the liberalization of the cocoa industry has contributed to a decline of yield and quality of cocoa beans for export and the local market. This is expected to affect cocoa earnings in terms of the premium payment on the international commodity market.

The role of warehousing and transportation in the cocoa supply chain is crucial since it precedes sale and export. Since problems are inevitable along the supply chain, unveiling the warehousing and transportation problems experienced by LBCs particularly at the peak seasons would be of paramount importance in the country's quest of further increasing sales and exports. Once determined, solutions to these problems could then be found to improve the crucial services of warehousing and transportation in the cocoa supply industry.

The main aim of the study was, therefore, to determine storage (warehousing) and transportation challenges of LBCs in the cocoa supply chain and their effect on the quality and postharvest losses of cocoa from Enchi A, Enchi B and Sefwi Wiawso cocoa districts. The specific objectives of the study were to;

1. identify the storage challenges of LBCs and assess their effect on quality and losses in cocoa from the districts;
2. identify transportation challenges and assess their effect on the quality and losses of cocoa from the districts and
3. estimate the storage and transportation losses incurred due to the identified challenges and their economic values.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 STRUCTURE OF THE COCOA SECTOR OF GHANA

The structure of the cocoa sector of Ghana has undergone several reforms. The structure of the cocoa sector was prior to the reform process characterized by complete unitary-buying to multi-buying systems. The market was in the hands of the government which through the Cocoa Marketing Board (CMB) was the only authorized domestic buyer and exporter of cocoa. The CMB carried out its activities through its subsidiaries, Produce Buying Company (PBC) and Cocoa Marketing Company (CMC). In addition, its subsidiary the Quality Control Division (QCD) was responsible for maintaining produce quality.

The first phase of the reform was initiated in 1984/85 and focused on restructuring the CMB. The CMB was streamlined through reduction of staff strength from 100 000 employees to 6 000 and also cut-down on organizational overlaps (Lunstedt and Parssinen, 2009). The many operational and institutional changes in the CMB led to changing its name to Ghana Cocoa Board (COCOBOD). During this initial phase attempts were made to restructure production by providing farmers with seedlings to replace old and non-bearing trees, promoting transport and sales by constructing and upgrading roads and putting greater emphasis on extension services geared to enhancing good agronomic farming practices.

The second phase, which was implemented in 1993, lead to the re-introduction of the multiple buying system where the internal/domestic marketing system was liberalized with the involvement of various licensed private companies inclusive PBC. The objective of the liberalisation reform was to introduce competition on the internal market and improve the supply chain aimed on one hand open up avenues for jobs and on the other increase operational and financial performance and efficiency (Laven, 2005).

More recent reforms, aiming at further increasing the efficiency and effectiveness of the cocoa sector, were implemented in 1999 in the government's Cocoa Sector Strategy. These reforms involved reducing marketing costs and taxes of COCOBOD, the privatization PBC in 2000 and improving the producer price to 70 percent of the world market price by crop year 2004/05. PBC was licensed on the Ghana stock market with COCOBOD owning 40percent and 30 percent indirectly through its ownership of major stakeholders.

The cocoa sector, as it is organized today, resembles a stabilization fund and is portrayed in figure 1 below. The main players are farmers, LBCs, Haulage Companies and COCOBOD. In addition, various government and business groups providing extensions and inputs to farmers as well as bank and credit facilitators are important actors on the market. The cocoa sector therefore consists of a chain of economic activities related to production, transportation, quality assurance and marketing of cocoa.

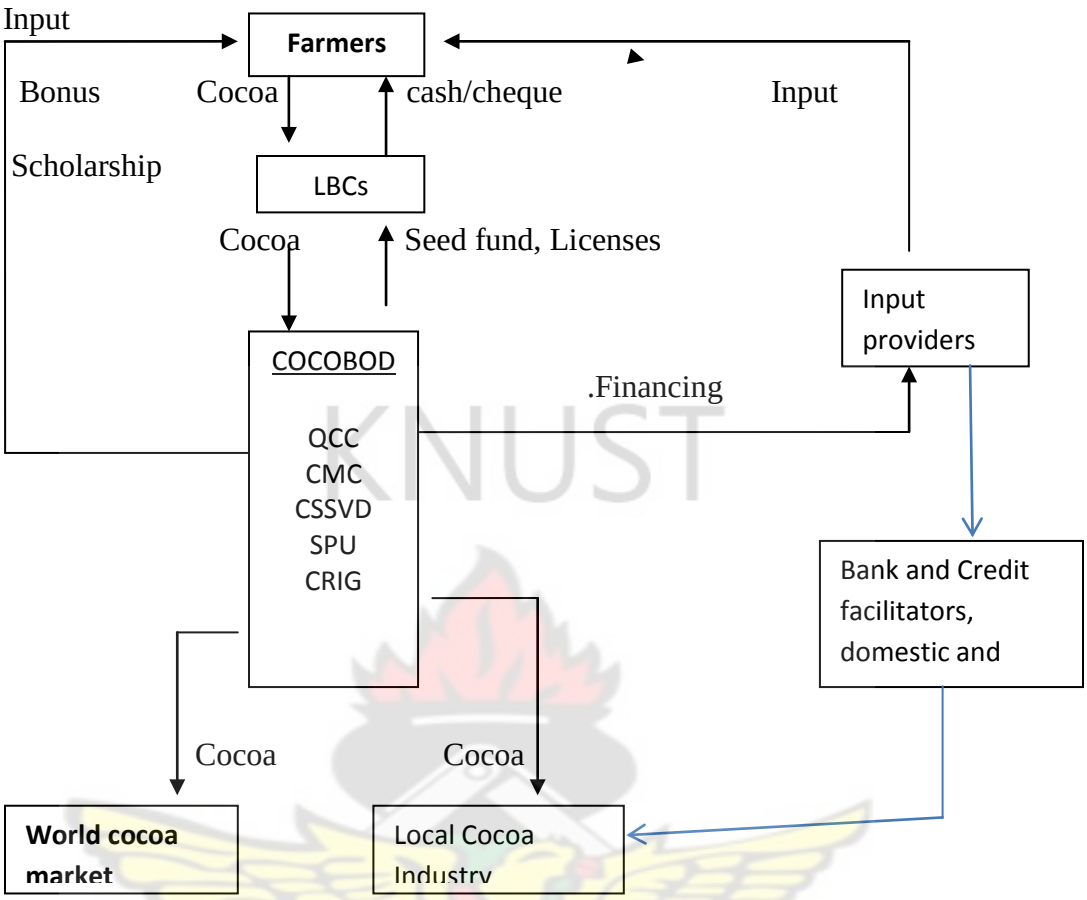

Figure 1: The Structure of the cocoa sector of Ghana.

Even though the internal market has been partly liberalized, it is controlled by the Ghanaian government. Through COCOBOD, the government controls cocoa quality, hands out licenses, finances and controls activities of LBCs and other private supporting companies, sets producer prices and margins, sells and exports to manufacturing and processing companies locally and abroad. The QCD (now QCC) and the CMC are still subsidiaries of COCOBOD and have the same responsibilities as prior to the reforms. Moreover, COCOBOD finances the Cocoa research Institute of Ghana (CRIG), distributes subsidized inputs and hands out scholarships to needy but brilliant farmers'

children (Van and Norde, 2003). The bulk of the Ghana cocoa is exported, while a minor share is sold to the domestic processing companies, whose products are mainly consumed locally and at a lower price and quality compared to the exported cocoa. The bulk of cocoa processed by the local companies are exported as confectionaries, liquor, powder and cake (Fold, 2008). Some local processing companies also produce cocoa butter out of sub-standard cocoa in soaps, creams and animal feeds.

2.2 LICENSED BUYING COMPANIES (LBCS) IN GHANA.

The most dominant stakeholders in the internal marketing structure are the LBCs. These LBCs can be found in all the six cocoa growing regions in Ghana. . However, Vigneri and Santos (2007) affirmed that, LBCs target districts where they can lower operational costs and maximize profit.

In Ghana most LBCs operate the district managerial system. Under this system the operational heads assess the funding needs of these districts; monies are then lodged in the accounts of the companies at the district. The district managers then release the funds either per the Akuafo cheque system or in cash to Marketing Clerks (MCs) who they coordinate to buy cocoa from their registered farmers. There are more than 3000 locations where LBCs buy cocoa through their registered MCs as agents. These locations are termed as societies/buying centres (villages, hamlets, cottages) and are manned by the MCs. The MCs after buying cocoa from the farmer prepares and bag it using a food grade jute sack at an acceptable weight and transport it subsequently to the central grading points/depots at the district level where the produce, so purchased, is inspected,

graded and sealed by QCC. The graded and sealed produce is transported in large quantities from the depots which are manned by depot/warehouse keepers to take-over points located in Takoradi, Tema and Kumasi (Kaase inland port). The cocoa is brought in truck loads and are subjected to further quality and weight checks before they are taken-over into warehouses at the take-over centres for storage to await export.

The LBCs in Ghana are solely responsible in buying dried cocoa beans from cocoa farmers in the country. They sell them to COCOBOD who in turn export them or sell them to local manufacturers. The number of registered LBCs has increased gradually since the liberalisation reform. Initially six companies were granted licenses to operate on the internal market but today there are 36 active LBCs. Table 1 portrays the ranking of LBCs by market showing active LBCs increasing from 16 to 28 between 2004/05 and 2008/09 crop year. Table 2 Shows the ranking of all the current 36 LBCs as at 2012/13 main crop season according to truck allocations at the Tema and Takoradi ports The average number of LBCs per village increased by about 30 percent between 2002 and 2004 implying that the potential trading partners of cocoa farmers increased significantly over the years (Vigneri and Santos, 2008).

LBCs can be divided into four categories depending on the ownership structure of the company. The first category comprises the former subsidiary of COCOBOD – now PBC Ltd. The second category of LBCs consists of domestically owned LBCs. Many of these Ghanaian companies are former transport companies that were contracted by COCOBOD prior to the liberalization reform.

Table 1: Ranking LBCs by market shares

	LBC	2004/06 (%)	2005/06 (%)	2006/07 (%)	2007/08 (%)	2008/09 (%)	5-Year Average (%)
1	PBC	37.60	32.76	30.28	30.63	32.87	32.83
2	AKUAFO ADAMFO MARKETING COMPANY	13.11	11.37	9.29	12.63	13.45	11.97
3	OLAM GHANA LTD	13.18	13.87	11.47	7.94	7.11	10.71
4	ADWUMAPA BUYERS LTS	7.24	8.95	9.75	9.02	8.14	8.62
5	FEDERATED COMMODITIES LTD	6.77	6.82	7.57	6.90	7.14	7.04
6	KUAPA KOKOO LTD	6.80	6.61	5.58	5.29	5.27	5.91
7	TRANSROYAL(GHANA) LTD	5.06	5.70	6.71	5.57	5.54	5.72
8	ARMAJARO (GHANA) LTD	5.36	4.97	5.12	6.86	6.21	5.70
9	COCOA MERCHANTS (GHANA) LTD	2.12	2.37	3.59	3.33	4.36	3.17
10	DIABY CO. LTD	0.09	1.23	4.03	4.24	3.91	2.70
11	DIO JEAN COMPANY LTD.	0.38	1.26	1.73	1.30	1.66	1.07
12	ROYAL COMMODITIES LTD	0.45	0.79	1.09	1.19	1.69	1.04
13	SIKA ABA BUYERS LTD	0.10	1.89	1.00	0.99	1.24	1.04
14	CHARTWELL VENTURES LTD	-	0.13	0.95	2.25	0.68	0.80
15	SOMPA KOKOO LTD	0.90	0.68	0.52	0.43	0.49	0.60
16	WEST AFRICA EXCHANGE CO. TTD	0.33	0.49	0.75	0.26	0.07	0.38
17	COCO EXCO LTD *	0.41	1.12	-	-	-	0.31
18	EVADOX LIMITED	-	-	-	0.93	0.45	0.28
19	SUNSHINE COMMODITIES LTD*	-	-	0.57	-	-	0.11
20	ALLIED COMMODITIES	-	-	-	0.10	0.25	0.07
21	FEREDAY CO. LTD	-	0.04	0.03	0.10	0.12	0.06
22	FARMERS ALLIANCE CO. LTD **	-	-	-	0.03	0.10	0.03
23	CDH COMMODITIES LTD**	-	-	-	-	0.11	0.02
24	GHANA CO-OPERATIVE MARKETING CO. LTD	-	-	-	0.01	0.05	0.01
25	ABAPA GOLDEN LTD **	-	-	-	-	0.05	0.01
26	YAYRA GLOVER LTD**	-	-	-	-	0.04	0.01
27	ABOAFO BUYING CO. LTD **	-	-	-	-	0.01	0.00
28	DUAPA BUYERS CO. LTD **	-	-	-	-	0.01	0.00
TOTAL		100	100	100	100	100	100

*License withdrawn, **Newly licensed LBC,

Source: COCOBOD 2009.

Table 2: LBCs ranking by daily trucks allocations to Take-Over Centres.

	LBCs	No. OF TRUCKS ALLOWED PER DAY	
		TEMA	TAKORADI
1	PBC	27	23
2	AKUAFO ADAMFO MARKETING COMPANY	11	10
3	FEDERATED COMMODITIES LTD	7	7
4	ARMAJARO (GHANA) LTD	7	7
5	TRANSROYAL(GHANA) LTD	6	6
6	OLAM (GHANA) LTD	6	5
7	KUAPA KOKOO LTD	4	4
8	ADWUMAPA BUYERS LTS	4	3
9	COCOA MERCHANTS (GHANA) LTD	3	4
10	ROYAL COMMODIES LTD	2	2
11	SIKA ABA BUYERS LTD	2	2
12	DIABY CO. LTD	1	1
13	CDH COMMODITIES LTD	1*	1
14	SOMPA KOKOO LTD	1**	1**
15	DIO JEAN COMPANY LTD	1**	1**
16	EVADOX LIMITED	1**	1**
17	YAYRA GLOVER LTD	1**	1**
18	ABAPA GOLDEN LTD	1**	1**
19	ABOAFO BUYING COMPANY LTD	1**	1**
20	UNIVERSAL CO-OPERATIVE CO. LTD	1**	1**
21	ALHAJI SULEMAN INDUSTRIES LTD	1**	1**
22	SPLENDID BUSINESS SERVICES LTD	1**	1**
23	FREDAKO COCOA CO. LTD	1**	1**
24	FARMERS STAR LTD	1**	1**
25	FARMERS ALLIANCE	1**	1**
26	KUMAMKUMA CO. LTD	1**	1**
27	FORTUNE TREE CO. LTD	1**	1**
28	AKUOTECH CO. LTD	1**	1**
29	LIBERTY COMMODITIES LTD	1**	1**
30	TRADECO INTERNATIONAL LTD	1**	1**
31	NYONKOPA COCOA BUYING LTD	1**	1**
32	NYHIRA DUA GHANA LTD	1**	1**
33	FANTASY TRADING CO. LTD	1**	1**
34	BROSAMAN COMPANY LTD	1**	1**
35	NTHC COMMODITIES LTD	1**	1**
36	ENYIDADO COMMODITIES	1**	1**
	TOTAL	80	75

Source: Cocoa Board, 2012;

1*= One Truck every other day

1**= Two trucks per week

Global Haulage is an example of a successful former transport company that presently is a key shareholder in three major LBCs – Adwumapa, Federated Commodities and Trans Royal (Vigneriand Santos, 2008). Category three constitutes of the farmer-based fair trade cooperative Kuapa Kokoo. Kuapa Kokoo was established in 1993 by a group of farmers and with support from the British NGO TWIN Trading Limited. The fourth and final category of LBCs comprises the two international companies, Singaporean-owned Olam and British-owned Armajaro.

Both Olam and Armajaro are leading suppliers of cocoa and other commodities (such as coffee and sugar) on the world market and operate in all main cocoa producing countries. In Ghana they operate as buying companies, but their expertise includes origination, exporting and processing of cocoa (Vigneri and Santos, 2008). The international companies have access to foreign capital, an advantage that makes them less dependent on the seed fund.

Table 1 above, shows PBC has the largest five-year average market share of 33 percent. The second largest LBC is Akaufo Adamfo Marketing Company Limited (AAMCL) with an average market share of close to 12 percent. Olam, with its approximate market share of 11 percent, is the third largest LBC. The Global Haulage owned LBCs Adwumapa Buyers Limited (ABL), Federated Commodities Company Limited (FCL), Trans Royal Ghana Limited and Cocoa Merchant Ghana Limited (CML) are at fourth, fifth and seventh place and ninth, while Kuapa Kokoo Limited (KKL) and Armajaro Ghana Limited (AGL) are at sixth and eighth place. The eight largest LBCs together purchase

around 90 percent of all cocoa while the remaining companies only have marginal shares indicating that the market is dominated by few big players. When dividing the market shares into its categories, shown in table 1, it is revealed that domestically owned LBCs have increased their shares over the five-year period, while the shares of both Kuapa Kokoo and of Olam and Armajaro have decreased. The PBC strongly decreased its market shares in 2004/05 and 2006/07, but reversed the trend the years after. The reason for the increasing shares of domestically owned companies may be due to several factors appreciated by the farmers (Lunstedt and Parssinen, 2009: p29).

As at the 2012/2013 main crop season, there were 36 LBCs operating and their ranking with respect to how much cocoa they bought was used to determine the number of trucks they could off load at the two major take over centres per day by COCOBOD as below.

2.3: TRANSPORTATION

Transportation and shipping are often used interchangeably but has the same meaning as the movement of goods and cargoes from one point to the other. However in the case of this study, the term transportation is what is going to be used which also implies shipping. With the exception of transportation most of the logistics activities are site specific meaning many of the logistics activities in the supply chain are carried out at a particular location. Transportation on the other hand operates anywhere (Johnson, 1998) Transportation plays a major role in the economic success by allowing for the safe and efficient distribution of goods and services throughout the supply chain (Gilbert and Tollens, 2002). Transportation links the various logistics activities together.

Transportation is seen as the glue that holds the entire supply chain together since without it the supply chain will break down. Because raw materials will not get to warehouse and then to plants and also finished goods cannot get out to distribution warehouses and finally to customers. The efficient management of the transportation activities in terms of delivery gains competitive advantage for a company, that is when goods are delivered on-time and at a lower cost.

2.4: FACTORS AFFECTING TRANSPORTATION

a. Transit time: Is the time taken for a transportation mode to travel from its country of origin to its destination.

Motor carriers are the second fastest transporters of cargo aside air carrier. Due to the capability of ignoring transit terminal because of the operational independence of each trailer unit, each trailer has its own power unit so they go straight to consignee without passing by terminals and by so doing they travel faster. The transit time of motor carrier might be prolonged due to effects of weather and traffic on the roads which occur at peak seasons of the year.

Water carriers are the slowest of all the mode of transportation; they travel at the pace of snail because they make a lot of stopovers from one continent to the other. This transit time is compensated by the rate charged to transport cargos which are mostly lower than the other modes. This channel suffers from weather condition which affects navigation so makes travel time longer (Coyle ,2002).

b. Cost: The cost of transportation has always been a big issue for logistics managers. With the motor carriers rates charged per ton-kilometre, motor carriers are very expensive means of transport after air. Rates are directly related to speed; that is the faster the carrier to deliver cargo to the destination not only the terminal, the higher the cost as from the terminal it has to go the consignee. Due to this factor, commodities of high value are transported by motor which should be able to offset some of the cost of involved in transportation. With the ease of entry into the transport industry, it has boosted the competitive nature with more carriers entering the industry and offering lower rates and improved service to gain market and compete for freight. The nature of competition has reduced the transportation cost of shippers and improved profitability (Coyle 2002,).

With this being the cheapest form of transportation it has the capability of conveying any kind of cargo in whatever form. The initial investment is what is huge for the equipment and not the right of passage.

c. Accessibility: Accessibility is the ability of transportation to reach any required destination not a terminal. Motor carrier has the advantage of access than any other carrier in the industry, so there is a saying in the truck industry that "if it got there, a truck brought it". So no matter the mode of carrier used, motor carrier will be the last supporting transporter of cargo to the final destinations because of its reach. It is true that road transport has the wider access to location but it is affected mostly by infrastructure like road networks. Since all cocoa production is from the hinterland, it is most of the time difficult for haulage carriers to reach due to bad conditions of road network.

The reach of water carriage is very low and of great restrain to shippers who are not adjacent to waterway to use water transport directly. Even before water carrier could be used, motor carrier must be used to bring the cargo to the port of sail (Coyle 2002,).

d. Nature of Goods: Motor carriers transport manufactured commodities of high value over relatively short distance though some transport low value products over long distance. Products that are perishable mostly travel by air or road due to short transit time while cargoes of low value, high density that can be loaded and unloaded travel by water for long distances. There is required moisture content for cocoa beans before they are shipped. They should not exceed seven percent therefore much care is taken to maintain that amount of moisture. If the moisture exceeds the required amount, the beans get wet and start to mould before reaching its destination. To prevent the beans from getting wet in the cause of shipment, extra jute sack and desiccants are hanged in the container to absorb the moisture .When less, the beans are regarded burnt and of no use.

2.5: WAREHOUSING AND STORAGE OF COCOA

A warehouse is an essential limb of the industrial unit. It is the depository of all materials required by all industrial units and supplies materials as and when required. The variety of items stored is so large that a planned system is necessary to keep them safely and in order. The stored items should be identified and issued with minimum efforts and in minimum time. This calls for the following:

- An organizational structure suitable to carry on various activities efficiently and productively.
- Defining the functions and duties of each focal official.
- Developing systems for the standardization of operations and uniformity in actions.
- Developing and maintaining records for proper accounting, management information and analysis (Saxena, 2003).

Recent pressures on logistics, increasing customer service levels, inventory reduction, time compression and cost minimization have changed the structure of supply chains and the position and working of warehouses within the supply chains. Warehouses come in all shapes and sizes, from facilities of a few hundred square meters handling modest throughputs, to large capital-intensive installations with storage capacities in the 50,000 plus metric tons range.

Warehouses exist primarily to facilitate the movement of goods to the end user. Since warehouses, storage and distribution centers should operate as integral components of supply chains, key decisions when setting up such facilities must be determined by the overall logistics strategies for service and cost. Rushton, Alan et al (2000) identify the factors that should be considered in establishing a warehouse to include the following:

i. Market and product base stability – Long-term market expectations for growth and for how the product range may develop will influence decisions on the size and location of a warehouse facility, including space for potential expansion.

ii. Type of goods to be handled – Goods handled can include raw materials, work in progress, spare parts, packaging materials and finished goods. Subject to material types, sizes, weights, product lives and other characteristics, special requirements for temperature and humidity may also have to be met and all of these will impact on the type of warehouse and technology level.

iii. Type of facility, size and location – The type of operations, design capacity, size and location of the warehouse will all be influenced, if not directly determined, by its specific role and position in the supply chain, and the role, capacity and location of any other facilities in the chain. The customer base, amount of inventory, the need for inventory reduction, time compression in the supply chain and the overall service levels should all be considered when deciding on the type, size and location of the warehouse.

Warehousing takes up to between 2% and 5% of the cost of sales of a corporation (Rushton et al, 2000) and with recent renewed corporate emphasis on Return on Assets, minimizing warehousing costs has become an important business issue. In today's highly competitive global business environment, many firms are automating their basic warehousing functions to achieve the increase in throughput rates or inventory turns required for their warehousing operations to be cost effective. At the same time, continued emphasis on customer service exacerbates the quandary of warehouse managers looking for ways to trim costs and improve customer service at the same time (Frazelle, 2001).

Warehousing (storage) follows directly after production. The critical role of warehousing in the cocoa supply chain is apparent from the fact that it precedes sale and export. Investigating warehousing problems in the cocoa industry can therefore be regarded as half of the solution to problems associated with increasing profitable sales and export. Problems of cocoa warehousing can be denominated under space availability and quality control.

Cocoa is brought into their village level depots by the farmers and quickly moved to larger sheds of the LBC's. Shed gangs build the bags of cocoa into stacks by hand or sometimes mechanically use high-mast battery-operated forklifts. Every effort is made by the dealers to avoid storing cocoa in the open, but where this is unavoidable, pallets are doubled to prevent problems from ground moisture and the produce covered immediately with a durable tarpaulin (Jonfia, 2002). The cocoa is then transported to the district warehouse and, at the district warehouse the bags are standardized to meet export regulations. The QCD now QCC Ltd is then called in to check the quality. They perform a cut test and bean count onsite; and grade and seal the bags for onward movement to terminal warehouses at the ports.

The cocoa industry has not been impervious to changing market trends. Traditionally, cocoa beans were stored and transported in bags owing to the difficulties associated with bulk storage. But modern bulk storage have overcome this problem and today European buyers prefer to make savings on bags and labour by receiving the cocoa in bulk (GHPA,

2006). Unicontrol Commodity Company (Gh) Limited (UCC), a subsidiary of the Dutch group, Unicontrol Holding B.V., which was established at the Takoradi Port, now operates an innovative bulk storage and ship-loading facility for cocoa beans handling over 200,000 tons annually. The company operates three warehouses in Takoradi with a total capacity of 30,000 metric tons. The warehouses are equipped with mobile weighing surveyor belts, pay loaders and hoppers with scales attached (Unicontrol Commodity, Handbook on bulk cocoa handling).

2.6: CHALLENGES OF COCOA STORAGE

According to Saxena (2003), the stores division/warehouse is often criticized for various reasons, some of which are genuine problems faced by the users and could be overcome by proper planning and organization. Some issues are difficult to resolve due to limited resources at the command of the stores. The main criticisms are:

2.6.1 Poor Inventory Control

Maximum and minimum levels are not maintained properly. Normal items of regular consumption such as cocoa in our case are frequently out of stock. Replenishment of materials is not done with efficiency. There are a number of obsolete items in the stores. There is no control over the slow moving and non-moving items (Saxena, 2003).

2.6.2 Improper Store-Keeping

Materials are not stored properly which result in spoilage. Important and costly materials are stored in open yards. Some items are found at two different locations. Items stored in more than one store are not linked. (Saxena, 2003)

2.6.3 Delays in Inspection

Delays in inspection of items received in the stores. Timely information is not given to the user for inspection of the items. Mistakes in counting the quantity of the materials and in some cases even incorrect identification of the items.

2.6.4 Poor Records Keeping

Records are not up to date. Retrieval of information takes too much time. Store records are not reliable. It takes a long time to establish the correct status of the stock. (Saxena, 2003)

2.6.5 Delay in Reporting

Reports on critical items are not submitted to management on time. Empirical literature on space availability and process effectiveness in cocoa warehousing is scanty. An assessment of problems associated with space and warehousing management in the cocoa industry is therefore a useful addition to the literature.

In conclusion, the literature recognizes that, a good warehouse provide enough space to handle materials in large quantities, which enhance offloading of materials from trucks as well as reducing cost of transportation and truck turnaround time. However the warehousing facilities for storing cocoa at the Port and districts is bedevilled with a lot of problems such as limited warehouse space which affect the storage of enough cocoa beans at these warehouses. This situation adversely affects the foreign exchange to be

earned by COCOBOD and Ghana as a whole. Hence assessing these problems and recommending measure to minimize such exposures (Saxena, 2003).

2.7 QUALITY OF GHANA COCOA BEANS

Quality is important since it determines prices, credibility and reputation of cocoa. The high quality level in Ghana is an outcome of COCOBOD's control systems that promotes the use of adequate cultivation practices among farmers. In order for COCOBOD to continue selling its cocoa on the forward market and receiving the price premium, its reputation as a high quality cocoa producer must be maintained. Without the use of forward sales contracts as collateral for discounted international loans, the prevailing price setting system would not exist. Hence the possibility of setting a fixed producer price and other profit margins, as well as providing the seed fund to the LBCs, are dependent on the preservation of the market structure (Laven, 2005) and sustainability of quality.

In countries like Cameroon and Nigeria, the presence of forward sales has been eliminated, since there is no marketing board or other Governmental organisation in charge of guaranteeing export volumes and quality (Varangis and Schreiber, 2001). It is argued that the quality of Ghanaian cocoa has declined since the liberalisation of the internal market. The LBCs' competition to increase their market share and profit margins, pressure farmers to sell cocoa which hitherto are not well fermented or well dried with the promise of re-drying thoroughly to meet the standards acceptable for export (Laven, 2005).

Farmers find it difficult to hold on to their produce till they are properly prepared and ready for sale despite the fixed and guaranteed producer price because of lack of other incentives to augment proceeds from cocoa. This practice has been confirmed in interviews with farmers and implies that farmers are not properly rewarded for maintaining good quality, which yet again indicates that it is mainly COCOBOD that benefits from the high quality standard (GAIN, 2012). Other reasons put forward to explain the possible quality downturn are problems associated with smuggling and cross-border trade with neighboring countries, fast increasing volumes of cocoa produced and extensive planting of hybrid trees. However, the quality level of Ghanaian cocoa is still high and the price premium received. The main reason is probably the strict quality control system ensured in Ghana, combined with a traditional attention for the crop and favourable weather conditions (Lunstedt and Parssinen 2009).

Ghana cocoa beans have long been known for their quality and depth of flavor. According to the International Cocoa Organization (ICO) Ghana cocoa is richer in Theobromine and Flavonoids which have given the beans the unique, mild and rounded flavor. As such the quality of Ghana cocoa beans have become the world's standard against which all cocoa is measured. The International Cocoa Standards require cocoa of merchantable quality to be fermented, thoroughly dried, free from smoky beans, abnormal or foreign odor and free from any evidence of adulteration. It must be reasonably free from living insects, broken beans, fragments and pieces must be seasonably uniform in size. Manufacturers want beans that are fully fermented, not brown break, slaty or purple.

Cocoa from Ghana continues to enjoy high premium on the World's Commodities Markets because of its unsurpassable high quality and the COCOBOD grading mechanism has done much to ensure it remains so. Buyers of cocoa pay high premiums because of the high quality of the beans (GAIN, 2012). Quality control of cocoa beans is very rigorous. The high quality of Ghana cocoa beans has been diligently maintained over the years, through the effective quality control practices and monitoring at the time of purchase by the Quality Control Company (QCC) of COCOBOD. As part of their responsibility, the Quality Control Company undertakes fumigation and disinfection of beans against storage insects in warehouses, to ensure that only insect-free cocoa beans are exported; rodent control is also carried out in all cocoa storage premises to prevent damage to the beans in storage; and inspection, grading and sealing of cocoa for the international and local markets (GAIN, 2012). Ghana cocoa is subjected to a minimum of three stages of quality inspection prior to shipment. This gives added assurance and confidence to the customers to buy Ghana Cocoa at all times.

Quality Control Company (QCC) of COCOBOD's monitors the quality of the beans along the cocoa value chain from production to export. QCC provides all the inspection, grading and certification services. First inspection takes place at the society/village level before purchase is done by the LBC's marketing clerks (MC). A second inspection is carried out at the District depots by QCC before movement to take-over points at Kaase in Kumasi, Tema and Takoradi ports. A third inspection is carried out at the port before the cocoa is taken-over by CMC and a final inspection, before shipment/export. All such

quality checks are done to ensure that the quality, as seen during original inspection and certification is maintained and consistent.

Ghana's cocoa beans are rated to be of premium quality as a result of the following: the fixed producer prices in Ghana that results in farmers not being pressured to sell their produce too early (or too late) by a fluctuating price, but at moments when quality is optimal, and; the methodical infrastructure of QCC in Ghana that checks the quality of the purchased cocoa on three different points in the chain before shipment. If quality compliance fails, the cocoa is sent back to the LBC, using a good system of traceability. This system enables the LBCs to blacklist recalcitrant farmers.

2.8 CHALLENGES FACED BY LICENSED BUYING COMPANIES (LBCS) IN GHANA

There is usually the perception of quality deterioration arising out of competition due to liberalization. It is argued that liberalization of markets for tropical crops may lead to decline in export quality. Gilbert and Tollens (2002) looked at this argument in the specific case of Cameroonian cocoa exports. They concluded that there is no evidence pointing to significant quality problems arising from market liberalization. Rather it was observed that increased competition among buyers resulted in intermediaries taking over some processing functions of farmers. Vigneri and Santos (2008) also reported similar allegations of LBCs cheating farmers by fixing scales and pressing farmers to sell not thoroughly dried (NTD) and under-fermented cocoa to increase their turnover of cocoa

loads. These had detrimental effect on the quality of the beans and ultimately, on farmers' benefit from cocoa sales.

2.8.1 Low Buyer Margins

The Ghana Cocoa Farmers Survey (GCFS) data between 2001/02 and 2003/04 provide information on active LBCs in selected villages over the course of two rounds of survey. The survey revealed that six LBCs operating in 2001/02 had gone out of business by 2003/04. Zeitlin (2006) concluded that the bankruptcy rate among LBCs was so high that margins paid by government for cocoa delivered do not allow for easy operations in the purchasing market. Margin paid to traders as fixed by the government in Ghana was noted to be one of the lowest in the sub region as found in Vigneri and Santos (2007) report.

2.8.2 Excessive Market Power of COCOBOD

The market power exercised by COCOBOD using its regulatory arms QCD and CMC in the Ghana cocoa industry makes it extremely difficult for many LBCs to operate efficiently. Firms are at the receiving end of policies affecting them without being consulted during formulation of said policies (Adu, 2007). However, it is also understood that if the export market of cocoa in Ghana be liberalized with the inclusion of other LBC, could affect the country's credibility in quality and subsequently acceptability of the produce on the commodity market. CMC of COCOBOD has a very high respectability with a proven track record and confidence from partners in the cocoa trade. The erosion of such acceptability rate is reasonably guarded.

2.8.3 Poor Financial Management.

A look into the history of private participation in internal marketing of cocoa in Ghana shows various approaches to buying have been tried involving multiple firms since 1947 but could not be sustained and was abolished in 1977. The reasons for the abolishing of the multiple buying systems were various. A few of which are; the lack of adequate working capital and over reliance on the then Cocoa Marketing Board for funds. The improper and unreliable records of these firms created problems for the Boards forward sales planning and others concerning produce traceability. Most firms incurred heavy losses and could not cover for their operational cost some of which were as a result of diversion of funds into other activities unrelated to cocoa, fraud and general misappropriation of funds.

The lessons of the past was expected to guide the reintroduction of multiple buying but the system as it is now has not been without its own inherent challenges. The internal marketing business model is attractive from the outside but being price takers, these firms are at the receiving end of the board's policies which have almost always been top down in approach. Kusi (2006) raised issues affecting the smooth operations of the Produce Buying Company (PBC), the leading LBC in terms of market share in Ghana. His comments summed the frustrations of LBCs between 2004/05 and 2005/06 seasons.

2.8.4 High Finance Cost

The cost of borrowing is expensive on the finance market in Ghana. This coupled with the time it takes to get funds locked up in stocks of cocoa released makes it very risky to

do business in the industry as an LBC (Adu, 2007). Access to funds is yet another challenge especially for new entrants. COCOBOD usually do not advance seed money to new LBCs until after the first year of operation. And to qualify for renewal of LBC license a firm must have at least purchased 2000 tons of cocoa by the end of the crop season.

This excludes LBCs cost of inputs and warehouses to get the business going. It has therefore become a ritual that about one half of all newly licensed LBCs are either inactive or fold up before their fifth anniversary. The rejection of huge stocks of cocoa due to non-compliance by LBCs over produce categorization and bean uniformity by COCOBOD through its quality control outfit, QCC resulted in stock hold ups up-country in the 2004/05 season. Huge stocks of cocoa up-country and at the ports were rejected for re-standardization on issues regarding purple beans to meet export demand. COCOBOD decided to pay LBCs a percentage of the actual purchase price paid for cocoa from the farm-gate. The holding of stocks was for several months.

2.8.5 Unfavourable Operational Environment

The Produce Buying Company (PBC) asked for serious evaluation of current relationship between LBCs and COCOBOD and its subsidiaries that regulated the cocoa industry. This is as a result of the unfavourable operational environment and bureaucracy of COCOBOD putting severe strain on the finances of the company. This forced the company to record net operational loss of about $3.1million for year 2005 and a reduction in shareholder funds by 37 percent (Adu, 2007)

2.8.6 Competing in Volumes Instead of Price

Laven (2007) concluded that LBCs are constrained by the fixed pricing regime to compete on volume instead of price. In such a situation LBCs have to adopt many non-price strategies such as 'investing in local purchasers of cocoa and making sure the MC is trustworthy and motivated to serve farmers' needs; investing directly in farmers and providing them with prompt payment, bonuses, gifts, rewards, (subsidized) inputs credit and training, and invest in maintaining durable social relations with their suppliers.

2.8.7 Poor Infrastructural Facilities

There is inadequacy of storage facilities up-country on the part of LBCs and at the ports for COCOBOD's utilization. COCOBOD collaborates with private entities that have the capacity to invest in storage facilities. These results have reduced to some extent congestions at the ports in times of increased in production. According to Adu (2007), large sums of funds intended for the LBCs are locked up in stocks at the ports during the peak seasons of October to December and some cases January.

2.8.8 Funds Cycle Time

The profitability or otherwise of LBCs is also depended more on volume of produce purchased from the farmer than on price. The LBCs can manage the situation efficiently by prudently utilizing their cycle time (period within which funds locked up in stocks are released to be utilized again). Deliveries to the port must be followed by Cocoa Taken Over Receipts (CTO) as attached documents before LBCs can raise invoices for refund

from COCOBOD. This process can be unbearably long and frustrating, whereas interest charges on funds accrue (Adu, 2007).

In some instances the process from arrival of stocks at the port to issuance of invoice on COCOBOD may take more than 30days excluding the waiting period for payment. Repayment cycles are therefore extremely long leading to LBCs to limit search cost which incentive could adversely affect quality.(Adu2007).Even though there are strategies by COCOBOD to reduce the cycle time it needs to be improved.

2.9 CHALLENGES IMPACTING STORAGE AND TRANSPORTATION OF COCOA

Ghana's cocoa industry is constantly growing with several challenges in terms of storage and transportation.

According to Osei (2007), it is estimated that Ghana loses about 5% of its production annually. This is a huge concern to the Government of Ghana and other stakeholders such as COCOBOD and the Licensed Buying Companies (LBCs). It is evident that these losses are as a result of challenges associated with storage, handling and transportation of the cocoa which affects the quality of the produce.

Adu (2007) also explained that the small sizes and capacities of warehouses have negatively impacted on storage as this constantly leads to the storing cocoa outside the warehouse during the peak season. This also resulted in loss of cocoa through poor handling, theft and the erratic nature of the weather. A damp environment facilitates

moisture build up in the cocoa during such poor storage conditions and may cause the development of mouldy beans.

Warehouses have being identified to have various pests in the form of birds, insects, flies, rodents (rats and mice), scorpions, snakes and frogs in them. Although cleaning of the warehouse is supposed done on a regular basis, Anang *et al.* (2011) identified that this is a challenge which have been difficult to control.

GAIN (2012) reports explained that although storage facilities may face some challenges, it is necessary for all stakeholders in the cocoa industry to meet on regular basis to assess the situations and develop solutions to curb the effect on the quality of Ghana's cocoa on the international market.

Transportation issues identified by Vigneri and Santos (2007) showed that the evacuation of cocoa from the farmer through the Licensed Buying Company (LBCs) to COCOBOD take-over centres (TOCs) have several challenges that lead to the reduction in cocoa quality. It is obvious that cocoa stocks that do not meet the quality and standard for export are rejected at the take-over centre, sent to the discrepant shed of the LBC concerned for re-standardization. The part found to be unacceptable is discarded as cocoa waste. This considerably affects the value and price of cocoa. The common problems faced during transportation include: inadequate trucks, availability and high cost of fuel, high cost of spare parts and servicing as a result of tear and wear, frequent breakdowns of trucks in transit and poor roads.

Triana (2003) explicitly identified that cocoa quality is affected when other products are transported together with cocoa stocks. This tends to affect the colour, taste, flavour and general quality of cocoa beans. Sometimes, transporters were identified to carry other goods in addition to the cocoa. The other goods generally carried include agricultural produce (food stuffs) and charcoal. Transporters gave reasons such as providing help for stranded farmers and other passengers; a means of making some extra money; and doing friends and family members a favour.

CHAPTER THREE

3.0: METHODOLOGY

3.1 INTRODUCTION

The chapter discusses the research method to be used to achieve the objectives of the study. The chapter discusses the study areas, the population of the study, sample size, method of selecting the sample size, and methods of data analysis and presentation.

3.2: STUDY AREA

The study area comprises of Enchi 'A', Enchi 'B' and Sefwi Wiawso cocoa districts.

The three cocoa districts (Enchi A, Enchi B, and Sefwi Wiawso) were chosen as the study area. This is because they contribute immensely in the quantity of quality cocoa for marketing by COCOBOD for both export and the local market. To avoid being biased and improve the validity and reliability of the study, the simple random sampling technique was employed to select 150depots (50 depots from each cocoa district) and either the depot keepers or the District officers were interviewed.

3.2.1 Enchi A and Enchi B Cocoa Districts

The Enchi A and Enchi B cocoa districts can be located within the Aowin/Suaman District of the Western region of Ghana. The Enchi district is one of the highest cocoa growing areas in the Western region of Ghana and also the highest cocoa producing areas in the country. The Enchi district is divided into two A and B to enhance efficient monitoring and supervision by COCOBOD's subsidiary heads and other stakeholders established in the district.

The Aowin Suaman District lies in the mid-western part of the Western Region of Ghana. It shares boundaries to the South with Jomoro District, to the East with WasaAmenfi, to the North with Juabeso-Bia and Sefwi-Wiawso and to the West with the Republic of La Cote D' lvoire.The total land area of the district is 2,717 square kilometers. This constitutes about 12 percent (12%) of the Region's area of 23,921 square kilometers. The capital of the District is Enchi. Other major settlements in the district are Dadieso, Boinso, New Yakasi, Jema and Asemkrom.

The District is situated in the Wet-Semi Equatorial Climatic Zone with mean-monthly temperature of 27 degrees Celsius. It experiences two rainy seasons. The major rainy season occurs from May to July and the minor September to October. Generally, the annual rainfall is between 1500 and 1800 millimetres (GhanaDistricts.com, 2011). The vegetation covers are moist-eemi-deciduous forests, found in the central and northern parts of the district and Rainforests located along the eastern and western fringes. The Rainforest is normally constituted by forest reserves and sacred groves, Mahogamy, Odum, Dahomaetcetra trees found in the forests are of great economic value hence a high number of timber firms are operating in the district.

The average distance from Enchi to Takoradi the Regional capital is about 213 Km.

3.2.2 Sefwi Wiawso District

The Sefwi – Wiawso District is the seventh largest in the Western region. It lies in the north – eastern part of the region. It is bordered to the north by the Brong Ahafo region.

To the west, it is bordered by Juabeso and Bia Districts and by Aowin Suaman to the South. It is also bordered by Bibiani – Ahwiaso – Bekwai to the coast and Wassa Amenfi West to the south – east. Its size is about 2,634 square kilometers.

The district falls within the tropical rainforest climatic zone, with warm temperatures throughout the year with moderate to heavy rainfall. The district is roughly rectangular in shape with the district capital Wiawso, almost on the extreme eastern perimeter. Most of the district is made up of an undulating terrain. The drainage system is mainly derived from the Tano River and its tributaries, which cut through the district roughly in a north – south direction and enters the sea in Cote d'Ivoire.The average distance from Sefwi Wiawso to Takoradi the regional capital is about 219 Km without passing through Kumasi, but due to the poor nature of roads LBCs are forced to use the Kumasi rout to the Takoradi port hence covering about 364 Km.

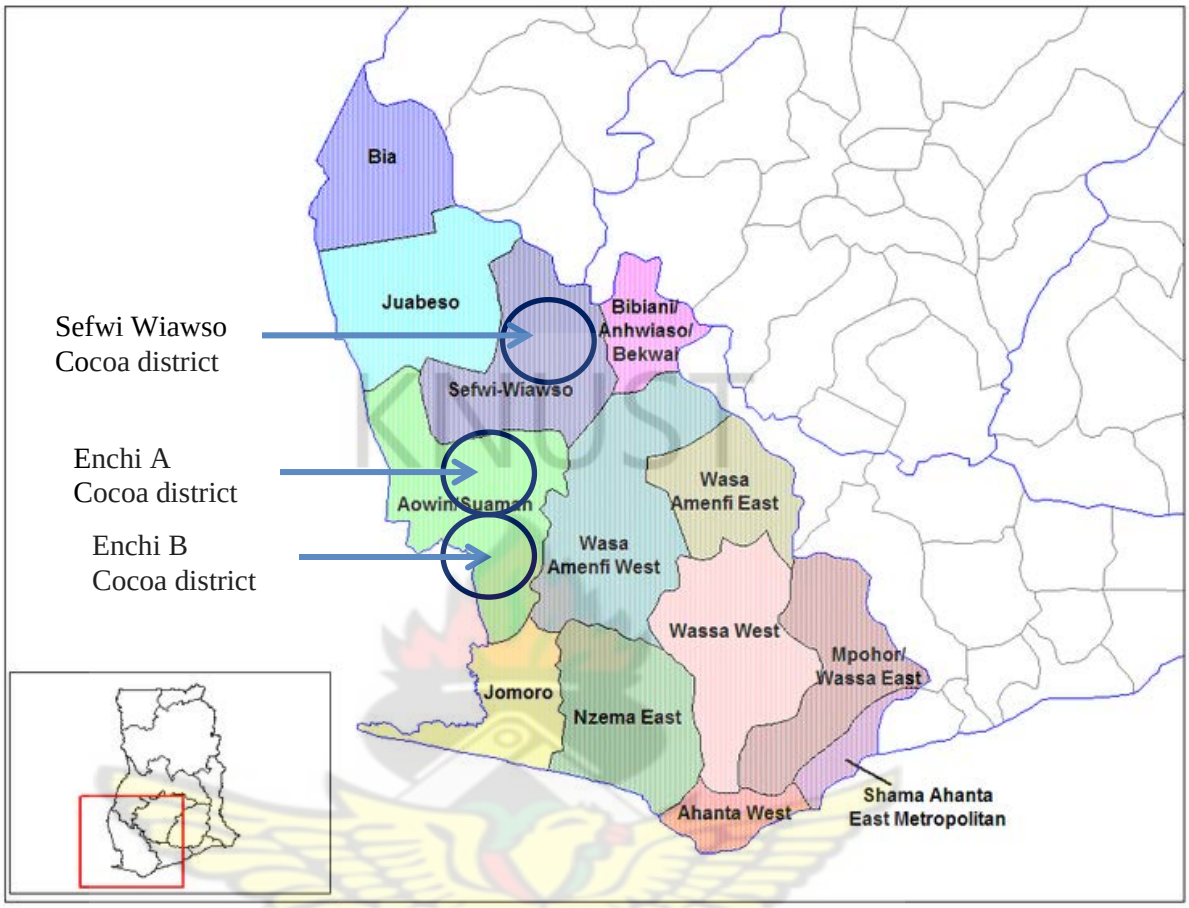

Figure 3: Map of the districts in the Western region showing the three cocoa districts

Source: GhanaDistricts.com, 2011

3.3 RESEARCH DESIGN

This section discusses how data for this study was collected and analyzed. These include the data collection through questionnaire administration, sampling methods and frame and data analysis.

The study was conducted in two parts; the survey and Field and Laboratory work

3.3.1 The survey

Primary data was derived from interviewing 150 depot keepers (50 from each district) through structured questionnaires administration and personal observations. Questionnaires were developed with a rated response technique from the Likert scale to enable easy analysis of data. The secondary data was sourced from institutions such as COCOBOD, MOFA, Licensed Buying Companies (LBCs), Quality Control Company Training school library, , the Universities in addition to consultation of relevant journals, dissertations and other publications.

3.3.1.1 Questionnaire design and administration

Open and close type questions were used in conducting the study as seen in the appendices. It was categorized into various sections focusing on the socio-demographic features, challenges faced by respondent during storage and transportation of cocoa beans and the estimated cost of rejected cocoa beans from the districts.

The questionnaires also sought information on pest forecasting, control and sanitation in warehouse management as well as the challenges encountered in maintaining the quality of certified cocoa before evacuation in the study areas. Prior to the questionnaire administration, a focus group discussion was undertaken to explain the purpose of the study and the questionnaire to them. Depot keepers and District officers who could read were given the questions to answer while those who could not read and understand were interviewed.

Pre-testing of the questionnaire was done at Aowin district and Tema Port to helped fine tune the questions and improved on the skills of the questionnaire administrators in order to have reliable and efficient data. The secondary data sources consisted of a desk study of books, dissertations, journals, correspondence, relevant information from the Ministry of Food and Agriculture, QCC Research Department, QCC Takoradi Port Records, the District and Municipal Assemblies, and other relevant agencies to extract information and statistics for the study.

3.3.1.2 Data analysis

The data collected was subjected to descriptive analysis with the use of bar charts and frequency distribution tables. Statistical tools including SPSS version 17 and excel sheets were used to produce graphs and frequency distribution tables with all the data pre-coded before the analysis. Statistical tests such as mode mean t-tests and chi-square as well as an analysis of variance (ANOVA); were also employed to analyze the questionnaires and results of analyzed cocoa samples. To improve the validity and reliability of the findings of the research study, the questionnaires were checked for errors and consistency.

3.3.2 Field Work.

Fifty (50) depots were randomly selected from each district and samples of cocoa were drawn for analysis.

3.3.2.1 Sampling of cocoa beans.

Cocoa beans were sampled from 20 selected depots in each district under the various storage conditions. Bags of cocoa were arranged in lots of thirties (30 bags per lot), ready for examination.

Ten of such lots were randomly sampled from each depot using stab-samplers provided by the chief inspectors of the districts in accordance with the Cocoa Industry Regulation (Consolidated) Decree 1968 (LI 598).

Samples from 100% of each of the ten(10) lots were bulked. Representative samples were picked from such bulks with the help of the cone and quartering method, sealed in sampling bags and taken to the laboratory for analysis.

3.3.2.2 Laboratory work.

Three hundred (300) cocoa beans were randomly picked from each of the 60 sampling bags (20 bags per district) and were cut for analysis.

The samples were analyzed per the standards of Quality control Company of COCOBOD as stipulated in the Cocoa Industry Regulation (Consolidated) Decree 1968 (NLCD 278) by the quality control officers of the respective districts.

Cut test analyses were conducted on all the cocoa samples collected. Defective beans; made up of mouldy beans, germinated beans, slaty beans weevil infested beans were picked. Further analyses were conducted to determine the grade of the samples in accordance with regulation 11 of the Cocoa Industry Regulation (Consolidated) Decree 1968.

3.3.2.3 Data analysis.

In order to ascertain the variation between the between data from field and laboratory work (analyzed cocoa samples from depots) and data from the Takoradi port records, an analysis of variance (ANOVA) test was carried This was to find out whether the defects as identified from the field work and analyzed cocoa samples really contributed to the rejections hence the cocoa losses estimated. The null hypothesis tested was

Ho: There is no significant difference between defects from field survey and the Takoradi port records.

The alternate hypothesis was

H1: There is a significant difference between defects from field survey and the Takoradi port records.

CHAPTER FOUR

4.0: RESULTS

4.1 INTRODUCTION

This chapter presents the results of the data analysis, and also discusses the various challenges and factors impacting storage and transportation of cocoa beans by the Licensed Buying Companies (LBCs).

4.2 SOCIO – DEMOGRAPHIC FEATURES OF RESPONDENTS

4.2.1 Gender of Respondents

The results showed that 90% of the respondents were males whereas 10% were females.

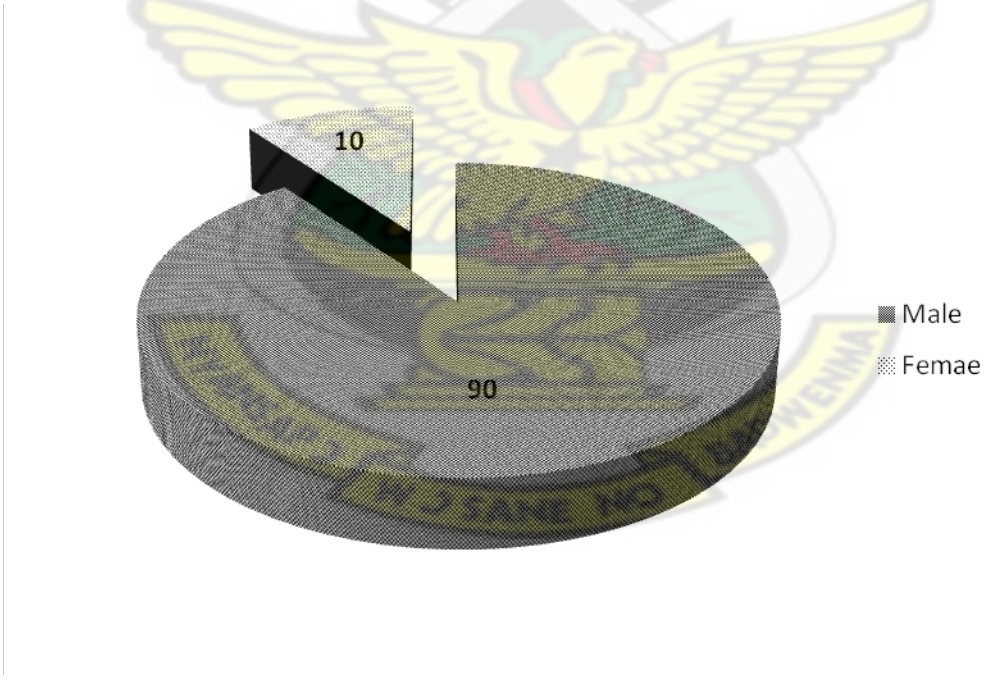

Figure 4.1: Gender of respondents

A cross tabulation between the gender and the cocoa districts also showed that all districts have males dominating activities in the storage and transportation of cocoa.

Table 4.1 Cross tabulation between Gender and the cocoa districts

District of respondents * Gender of respondents Cross tabulation

			Gender of respondents		Total
			Male	Female	
District of responders	Enchi A	Count	45	5	50
		% within District of respondents	90.0%	10%	100.0%
		% within Gender of respondents	33.3%	33.3%	33.3%
	Enchi B	Count	47	3	50
		% within District of respondents	94.0%	6.0%	100.0%
		% within Gender of respondents	34.8%	20.0%	33.3%
	Sefwi Wiawso	Count	43	7	50
		% within District of respondents	86.0%	14.0%	100.0%
		% within Gender of respondents	31.9%	46.7%	33.3%
Total		Count	135	15	150
		% within District of respondents	90.0%	10.0%	100.0%
		% within Gender of respondents	100.0%	100.0%	100.0%

The cross tabulation showed that Enchi B (94%) had the largest percentage of male respondents followed by Enchi A (90%) and then finally Sefwi Wiawso (86%).

4.2.2: Level of education of respondents.

The level of education of the respondents showed that 3.33% of the respondents had no education. About 20.67% of the respondents had completed Middle School / Junior High School and 38.67% had also completed Senior High School. The remaining 37.33% have completed Tertiary level or have a Diploma or Degree equivalent.

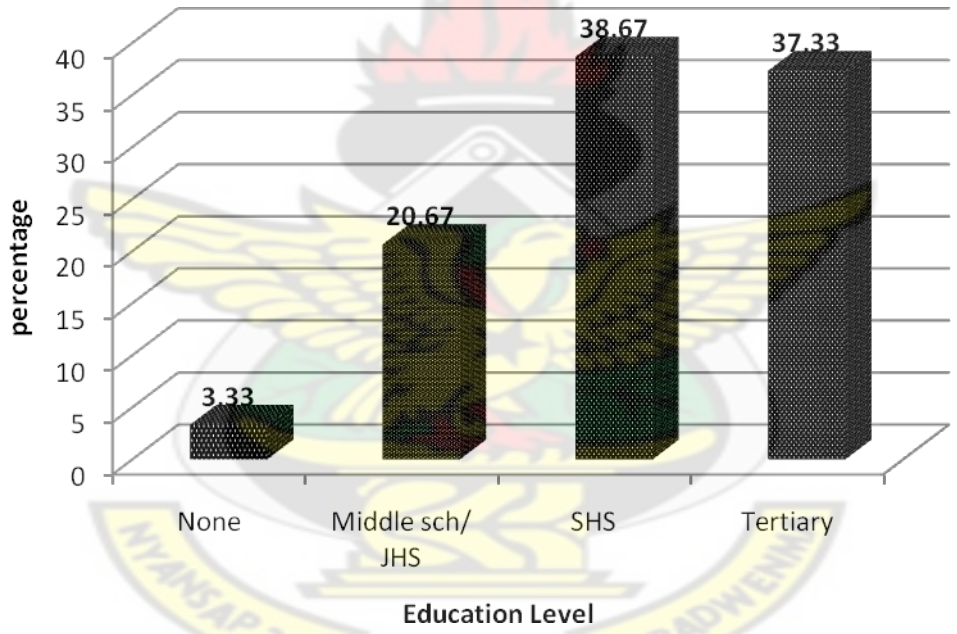

Figure 4.2 : Level of education of respondents.

4.3 STORAGE OF COCOA.

4.3.1Warehouse/Depot Sanitation.

Table 4.2 How often warehouses were whitewashed.

According to the respondents, 54% of the warehouses were whitewashed prior to the beginning of each of the two cocoa seasons. About 39.33% also identified that this was done annually. While none of the respondent reported to have whitewashed on a weekly basis.

	Frequency	Percentage
Weekly	0	0
Monthly	10	6.67
Annually	59	39.33
Prior to the beginning of each two cocoa seasons.	81	54
Total	150	100

About 95.33% of respondents testified that workers do not eat in the warehouse. The remaining 4.67% disclosed that workers eat in their warehouses.

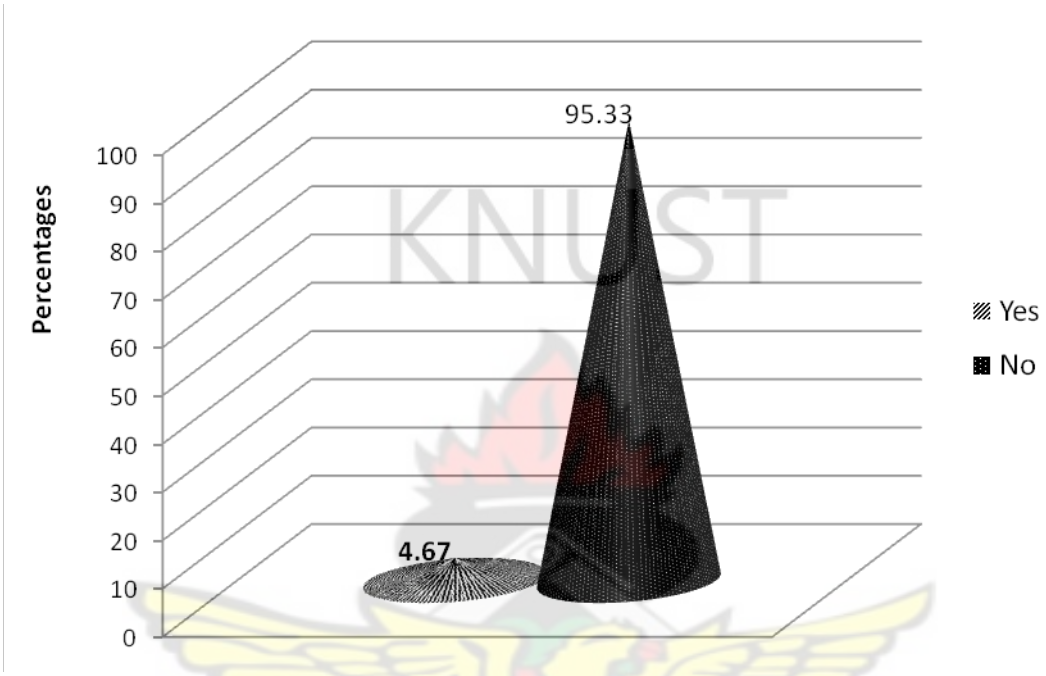

Figure 4.3: Workers eat in the warehouse.

About 11.33% of the respondents stated that the warehouses are swept on a daily basis. 30.67% reported they swept every other day. About 31.33% said they swept their warehouses/ depots on a weekly basis whilst 8% did it on a monthly basis. 18.67% explained that sweeping was done when the need arose.

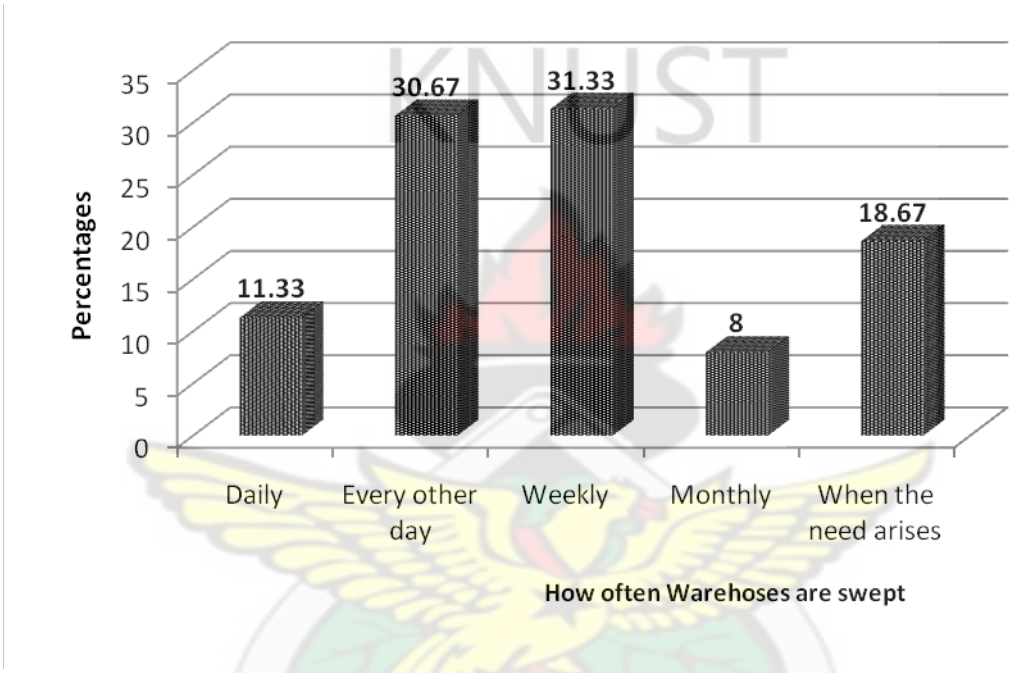

Figure 4.4 How often warehouses were swept.

About 21.33% of the respondents reported that they removed cobwebs from their warehouses weekly, while 37.33% did it on monthly basis. About 32.67% of the respondents reported the cobwebs were removed as and when noticed. 8.67% also explained that cobwebs were removed prior to inspection of the warehouses by authorities from Quality Control Company.

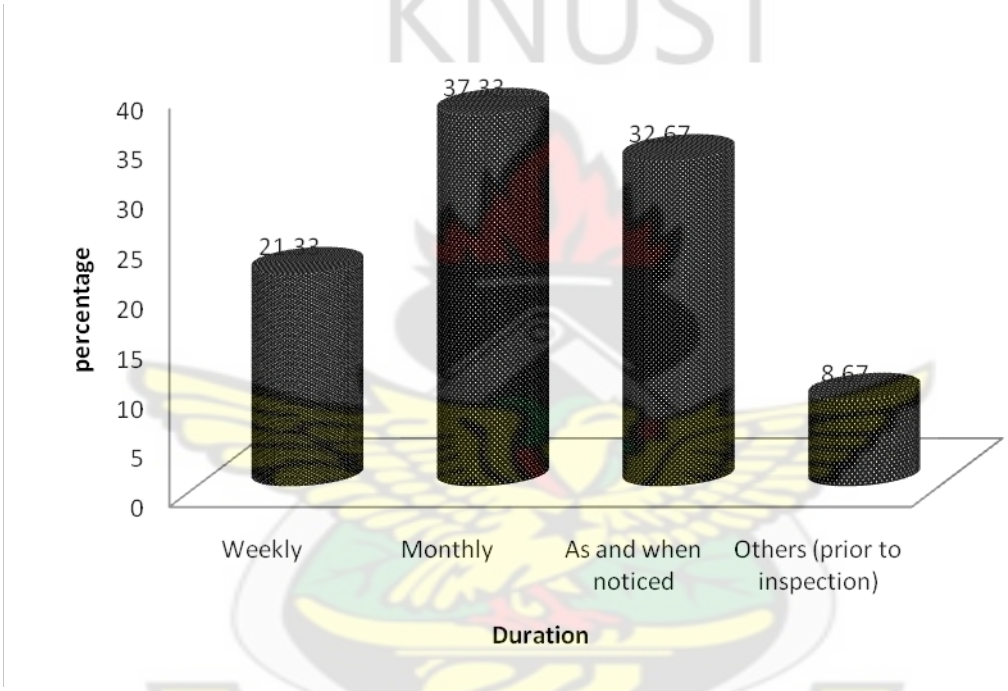

Fig 4.5 How often cobwebs were removed from warehouses

4.3.2 Average Warehouse Storage Capacities in Tonnes.

LBCs in Enchi B cocoa district had the largest average warehouse capacities of 696.4 tonnes. This was followed by Sefwi Wiawso cocoa district with 620.7 tonnes and then Enchi A cocoa district with 395.4 tonnes.

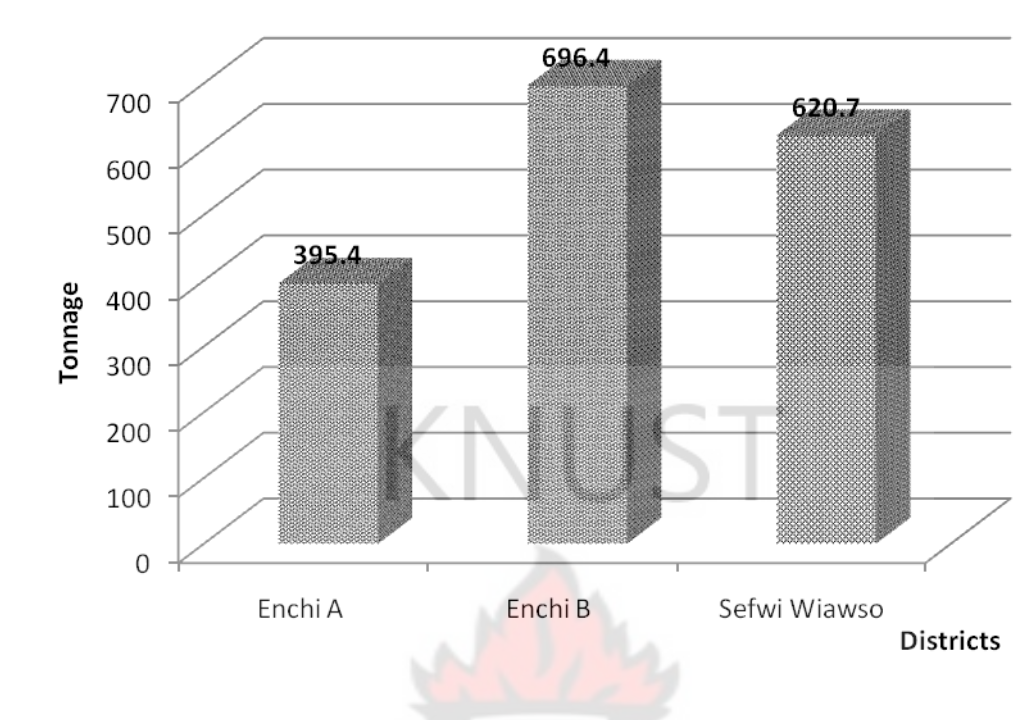

Figure 4.6 Average size of warehouse in tonnes

4.3.3 Cocoa Storage outside Depots during Peak Seasons.

About 95.3% of the respondents from Enchi A cocoa district testified that there have been instances where excess cocoa were stored in the open during peak seasons. About 23.3% and 10.7% of respondents from Enchi B and Sefwi Wiawso cocoa districts respectively admitted they stored cocoa in the open during peak seasons.

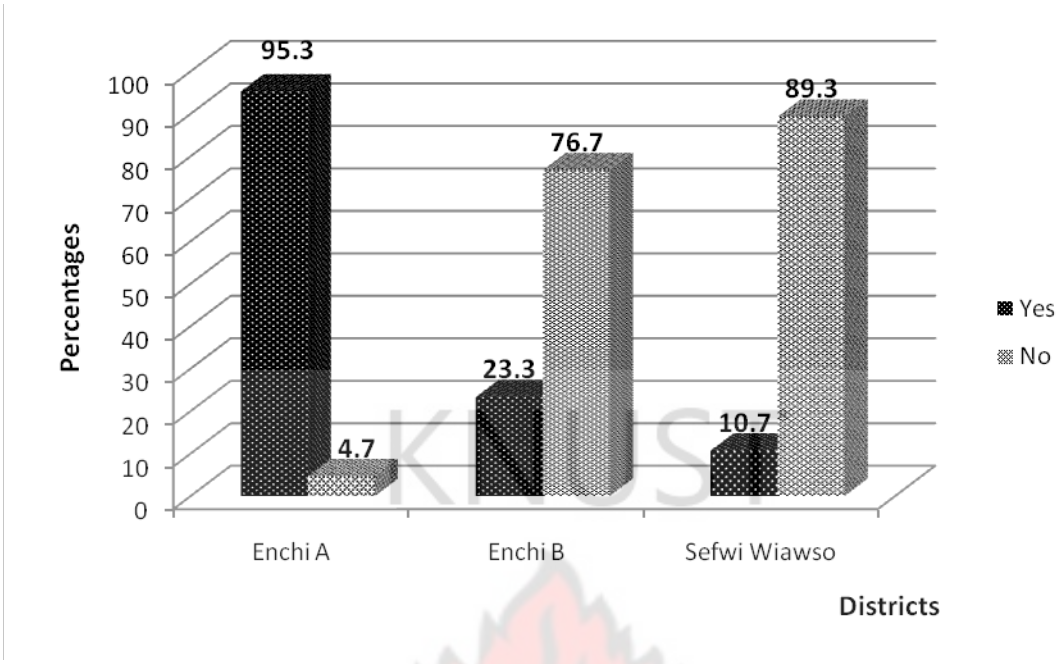

Figure 4.7 Instances where excess cocoa were stored in the open in depots during peak seasons.

4.3.4 Pests found in Warehouses/Depots

All respondents agreed that at a point in time, there were the presence of animals within the warehouse. 30% of the respondents identified birds as the primary pests in the warehouse. 25.3% also identified rodents such as mice and 23.3% identified lizards. About 9.3% identified insects, while other animals such as snakes, scorpions and frogs were identified by 12% of the respondents.

Table 4.3 Evidence of pests in the warehouses

	Frequency	Percentage
Birds	45	30
Rodents	38	25.3
Lizards	35	23.3
Insects (millipedes, centipedes, wasps, cockroach)	14	9.3
Others (snakes, scorpions, frogs)	18	12
Total	150	100

4.3.5 Cocoa loss due to Storage Challenges

LBCs in the Enchi B cocoa district had the highest loss of cocoa beans on the average as a result of storage challenges, as 56.7% of Depot keepers interviewed admitted they had loss less than 5% of cocoa in storage, 59% of them lost between 5 to 20% of cocoa in storage while 1.3% of the respondents lost more than 20% of cocoa in storage. This was followed by LBCs in the Sefwi Wiawso cocoa district with 3.3% of respondents admitting they had loss of more than 20% of cocoa as a result of the identified storage challenges. LBCs in the Enchi A cocoa district on the average recorded the least(0.7%) of more than 20% of cocoa as a result of the identified storage challenges.

Table 4.4 Percentage of cocoa beans loss as a result of storage challenges.

Percentage of cocoa Rejected	Enchi A		Enchi B		Sefwi Wiawso	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
< 5%	55	36.7	85	56.7	86	57.3
5 - 10%	84	56	40	26.7	41	27.3
10 - 20%	10	7.3	23	15.3	18	12
> 20%	1	0.7	2	1.3	5	3.3
Total	150	100	150	100	150	100
Mean	7.17		7.4		7.38	

In relation to the average percentage loss of cocoa per crop year due storage challenges, LBCs in Enchi B had the highest loss of 7.4% of cocoa followed by LBCs in the Sefwi Wiawso cocoa district with 7.38% and then LBCs in Enchi A with 7.17% which was the least loss of cocoa in storage.

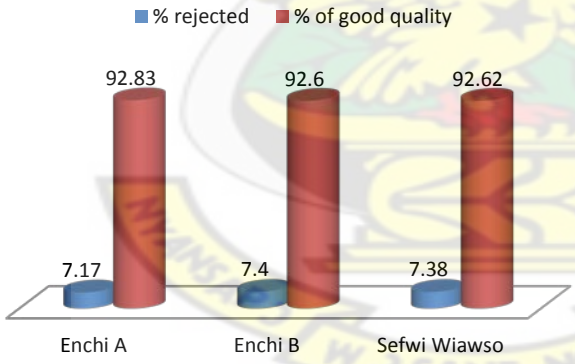

Figure 4.8 Percentage rejection of cocoa beans due to storage challenges.

4.3.6 Cocoa Storage Losses.

About 18.67% of the respondents identified rotten beans as the main form of storage loss experienced. About 20.67% identified mouldy beans as a loss experienced during storage per the crop year. Majority (24%) identified attack by rodents, whereas, 21.33% of the respondents identified insect infestation. A total of 15.33% identified other forms of loss such as theft to be the main form of loss experienced during storage.

Table 4.5 Forms of losses experienced during storage

	Frequency	Percentage
Rotten beans	28	18.67
Mouldy beans	31	20.67
Attack by rodents	36	24
Insect infestation	32	21.33
Others (theft)	23	15.33
	150	100

A cross tabulation between the forms of storage loss and the three cocoa districts showed that Enchi A cocoa district had the highest percentage (39%) of rotten beans. Sefwi Wiawso cocoa district recorded the highest proportion (52%) of mouldy beans. Sefwi Wiawso cocoa district also recorded the highest proportion (32%) of storage loss through attack by rodents per the crop year. Enchi B cocoa district recorded the highest storage loss (47%) in terms of insect infestation. Enchi A cocoa district also recorded the highest loss (70%) through theft.

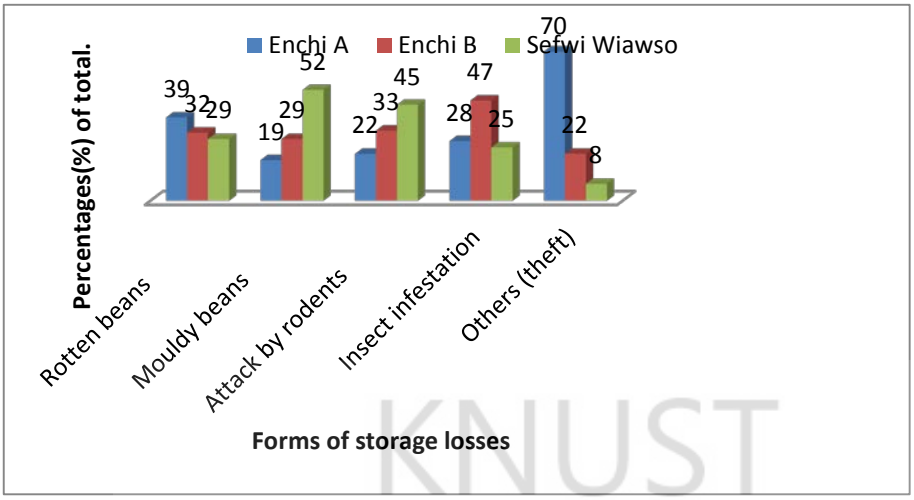

Figure 4.9 Cross tabulation between forms of storage loss to cocoa beans and the cocoa districts.

The Chi-square test value of 1.5762, at p=0.002 showed that the relationship between the percentage loss and forms of cocoa storage loss between the three cocoa districts is statistically significant. It was statistically significant at 1% and revealed that the storage procedure undertaken and the challenges facing storage at the warehouses significantly influence the percentage loss and forms of cocoa storage loss.

Table 4.6 Chi square tests for storage and percentage rejection

	Value	Df	Asymptotic. Significance. (2-sided)
Pearson Chi-Square	1.5762[a]	10	.002
Likelihood Ratio	135.416	10	.002
N of Valid Cases	150		

a. 32 cells (100.0%) have expected count less than 5. The minimum expected count is .66.

The symmetric measures of Phi and Cramer's V were used to measure the strength of association between the various challenges impacting storage and their effect on percentage loss. Both Phi and Cramer's V value of .655 at p= 0.003 showed that there was a strong association between the identified challenges affecting storage and their effect on the percentage rejection during storage and they were also statistically significant at 1%. This strong association is estimated to be about 65.4%.

4.7 Symmetric measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.654	.003
	Cramer's V	.654	.003
Number of Valid cases	150		

4.4 TRANSPORTATION OF COCOA

4.4.1 Duration of Evacuating Cocoa from Depots to the Port after Grading and Sealing.

About 3.33% of the respondents indicated that after grading and sealing, it took more than 1 month for produce to be evacuated from their depots. About 8% reported that it took 1 month, while about 23% of them said it took between two (2) to three (3) weeks. A majority of 65.33% reported they evacuated graded and sealed cocoa within a week.

Table 4.8 How long it took for produce to be evacuated, after grading and sealing from depots.

	Frequency	Percentage (%)
Within a week	98	65.33
Between 2 - 3 weeks	35	23.33
1 month	12	8
More than 1 month	5	3.33
	150	100

4.4.2 Reasons for Cocoa Rejections at the Port.

As a result of transportation inefficiencies, some cocoa from the districts (depots) were rejected and sent to discrepant sheds at the take-over centre. From the results, 44.67% of respondents indicated rain-wet cocoa bags as the reason for cocoa rejections at the take-over centre.

Dirty sacks as a reason contributed 11.33% t. Oil stains resulted in 22.67% of the rejected cocoa, while torn sacks and others such as weight loss recorded 12.67% and 8.67% respectively as a reason for cocoa rejections at the port.

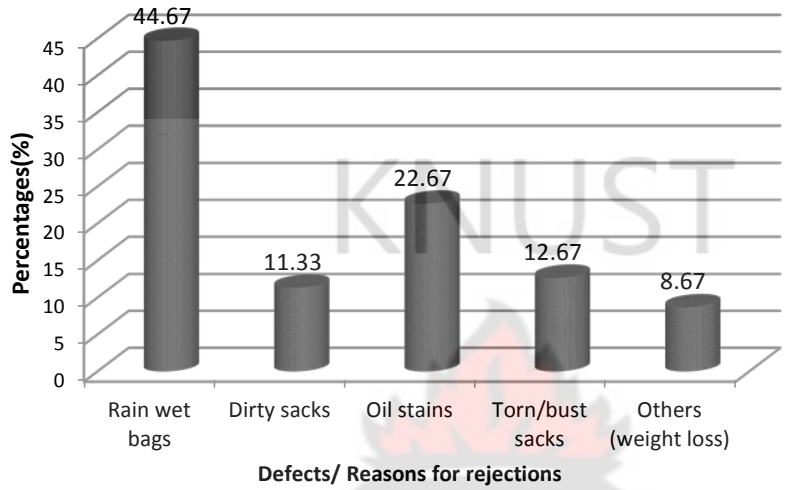

Figure 4.10 Reasons for which cocoa from depots are sent to discrepant (warehouse for rejected cocoa) sheds at the take -over centre.

The cross tabulation between the reasons for sending cocoa to discrepant sheds and the three cocoa districts showed that rejected cocoa from Sefwi Wiawso cocoa district represented (39%) of rain wet cocoa. Sefwi Wiawso cocoa district had the highest (58%) in terms of dirty sack rejected cocoa. For oil stained rejected cocoa, Enchi B cocoa district recorded the highest (44%). Enchi B cocoa district also had the highest (47%) in terms of torn/burst sacks. Enchi A cocoa district had the highest (46%) in terms of weight loss as a reason for rejecting cocoa.

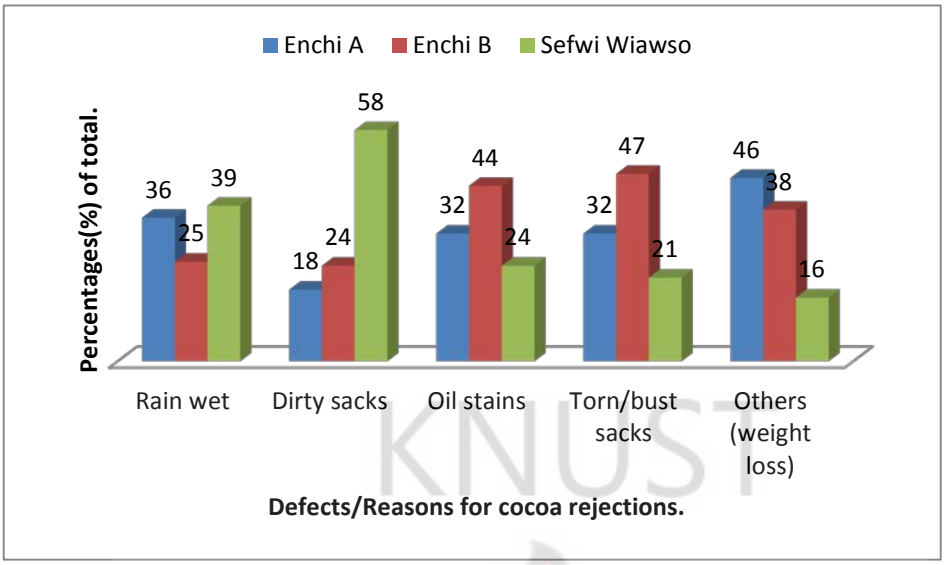

Figure 4.11 A relationship between reasons for sending cocoa to discrepant (warehouse for rejected cocoa) sheds and the three districts.

4.4.4 Problems Faced by LBCs during Cocoa Evacuation.

About 14% of respondents stated inadequate trucks during peak seasons as a common problem faced during transportation. A majority of 34.67% also reported unavailability and high cost of fuel as the common problem faced during transportation. 30% said high cost of spare parts and servicing. The remaining 21.33% also reported poor roads as the major problem faced during transportation.

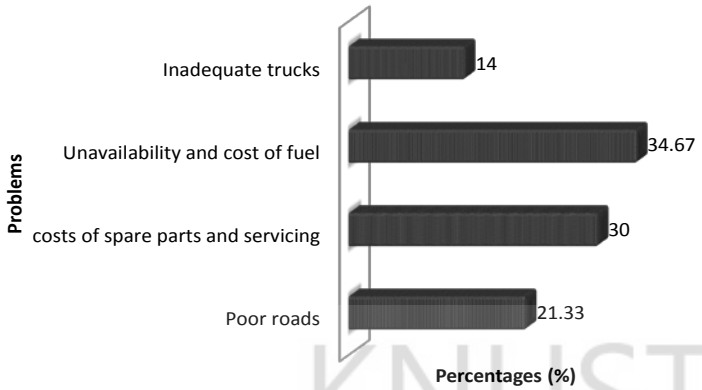

Figure 4.12 Problems faced during transportation.

4.4.5 Average Distance Travelled and Time Spent in Cocoa Evacuation.

LBCs in the Sefwi Wiawso district were found to have travelled the longest distances within 50 km radius in transporting cocoa from various societies to their grading centres while LBCs in the Enchi B cocoa districts travelled the least distances. In addition to that LBCs in the Sefwi Wiawso cocoa districts again were found to travel the longest distances for more than 200 km (54%) during cocoa evacuations.

Table 4.9 Average distances covered during cocoa evacuation.

Distance travelled	Enchi A(% of LBCs)	Enchi B % of LBCs)	Sefwi Wiawso % of LBCs)
Within 50km radius.	10	6	12
From 50Km to 100 km	16	14	18
From 100 Km - 200 km	34	42	16
Above 200 km	40	38	54
	100	100	100

About 10.67% of the respondents indicated that it took less than a day to transport cocoa from their depots to COCOBOD take-over centres while 89.33% said it took them a day to five days to evacuate cocoa to the port. However it took none of the respondents more than 6 days to evacuated cocoa to the port.

Table 4.10 Average duration in cocoa evacuation to the take-over center

	Frequency	Percentage
< 1 day	16	10.67
1 - 5 days	134	89.33
6 - 10 days	0	0
> 10 days	0	0
	150	100

4.4.6 Transportation of other Produce with Cocoa.

Fourteen (14%) of Depot Keepers/District officers interviewed in the Sefwi Wiawso admitted to have carried other goods (agricultural produce) in addition to cocoa during transportation, while 6% and 4% from the Enchi A and Enchi B cocoa districts respectively also admitted they had carried other goods (agricultural produce) with cocoa during evacuation.

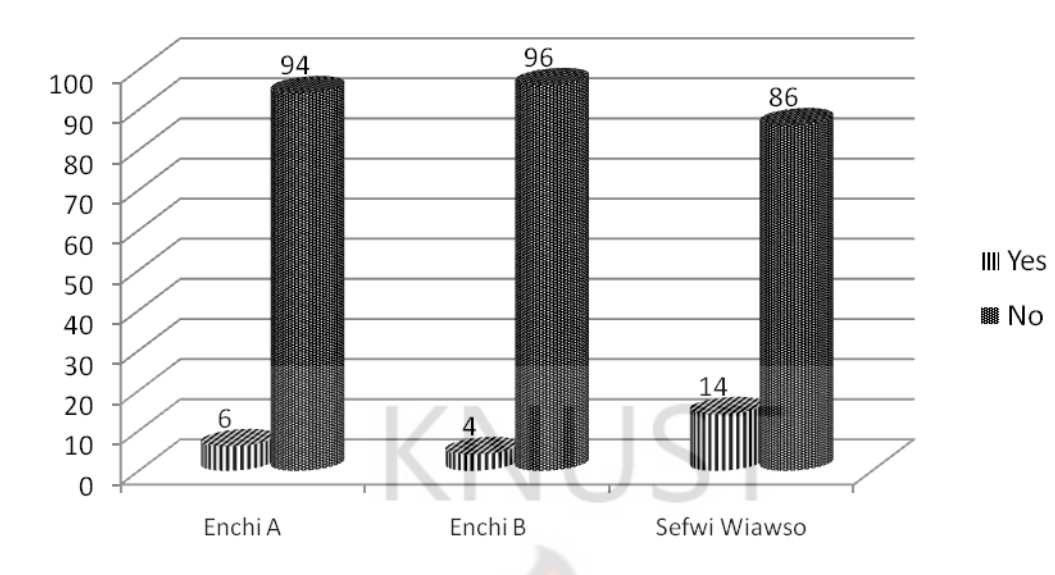

Figure 4.13 Haulage of other goods in addition to cocoa during transportation.

4.4.7 Cocoa Rejections Due to Transportation challenges

LBCs in the Enchi B cocoa district had the highest (8.55%) mean percentage rejections of cocoa at the port due to transportation challenges. This was followed by Enchi A with 7.8% of cocoa rejections, while Sefwi Wiawso had the least mean (7.6%) of cocoa rejected at the port.

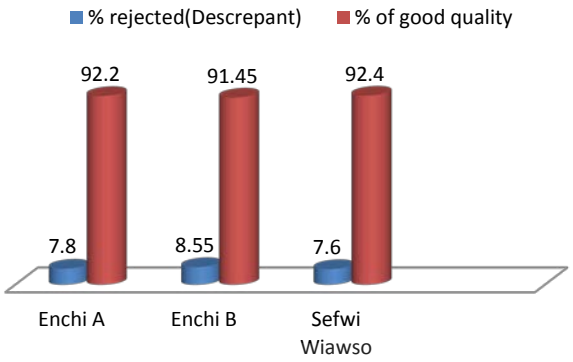

Fig 4.14 Mean percentage rejection of cocoa beans due to transportation challenges.

Chi-square test (value of 1.4365), performed on rejections due to transportation challenges for the three cocoa districts showed that the identified defects due to transportation challenges (rain-wet bags, dirty sacks, oil satin sacks, thorn sacks and weight loss) significantly (p=0.005) contributed to the rejections at the port. This is statistically significant at 1% and revealed that the transportation procedure undertaken and the various challenges affecting transportation significantly influence the percentage loss of cocoa during transportation.

Table 4.11 Chi square tests

	Value	df	Asymptotic. Significance. (2-sided)
Pearson Chi-Square	1.4365[a]	8	.005
Likelihood Ratio	126.896	8	.005
Number of Valid Cases	150		

a. 32 cells (100.0%) have expected count less than 5. The minimum expected count is .78.

The symmetric measures of Phi and Cramer's V were used to measure the strength of association between the various challenges impacting transportation and its effect on percentage rejection. Both Phi and Cramer's V value of .632, p=0.003 showed that there is a strong association between challenges affecting transportation and its effect on the percentage rejection due to transportation problems and they are also statistically significant at 1%. This strong association is estimated to be about 63.2%.

Table 4.12 symmetric measures of challenges of transportation and percentage rejection

Symmetric measures

		Value	Approx. Significance.
Nominal by Nominal	Phi	.632	.003
	Cramer's V	.632	.003
Number of Valid cases			

4.5 BAGS OF COCOA REJECTED AND ESTIMATED COST OF REJECTED BAGS

The table below shows the quantities of cocoa graded and sealed in the three cocoa districts as against the quantities that's are rejected at the take-over centre due to transportation and storage challenges

Table 4.13 Bags of cocoa graded and sealed against quantity rejected at the Takoradi port 2011/12 Crop season (Oct, 2011-Sept, 2012)

District	Quantity graded and sealed from Districts (Bags)	Quantity Rejected from Port (Bags)	% rejected (Bags)
Enchi A	371,196	42011	11.32
Enchi B	329,808	37654	11.42
Sefwi Wiawso	350,502	39833	11.36

Source: QCC, Tarkoradi port records. 2013

For the 2011/12 cocoa season, an estimated 11.32% of the cocoa sent from Enchi A cocoa district to the Takoradi port for export by the Licensed Buying Companies were rejected. Enchi B cocoa district recorded 11.42% whereas Sefwi Wiawso cocoa district had 11.36%. This shows that Enchi A had the least amount of cocoa rejected. The reasons for the rejected cocoa included Not Thoroughly Dried (NTD) (23%); Cocoon Infestation (8%); High Moisture content (47%); Short Weight (13%); Adulteration (2%); Wet bags (3%); oil stained bags (2.1%); Weak sewing (1.3%) and Burst bags (0.6%).

For the 2012/13 Main crop season, the number of cocoa bags rejected had reduced as compared to that of the previous year. However, the year is still in progress as of the time of the data collection. An estimated 5.67% of the cocoa sent from Enchi A cocoa district to the Takoradi port for export by the Licensed Buying Companies were rejected. Enchi B cocoa district recorded 9.73% whereas Sefwi Wiawso cocoa district had 9.75%. The reasons for the rejection of cocoa also included; Not Thoroughly Dried (NTD); Cocoon Infestation; High Moisture content; Short Weight; Adulteration; Wet bags; oil stained bags; Weak sewing; Burst bags.

Table 4.14 Bags of cocoa graded and sealed against quantity of bags rejected at the Takoradi port 2012/13 main crop cocoa season.(Oct, 2012-May 2013)

District	Quantity graded and sealed (Bags) from Districts	Quantity Rejected (Bags) from the Port	% rejected
Enchi A	240,286	13636	5.67
Enchi B	215,566	20968	9.73
Sefwi Wiawso	227,926	17302	7.59

Source: QCC, Tarkoradi port records. 2013

Table: 4.15 Secondary evacuation cost of transporting cocoa to Takoradi port

District	Cost (GH¢)
Enchi A	116.21
Enchi B	118.55
Sefwi Wiawso	142.41
Average	125.72

Source: Cocoa Marketing Company Ltd, 2012

4.6 ESTIMATED COST INCURRED AS A RESULT OF THE BAGS OF COCOA REJECTED FROM THE DISTRICTS FOR 2011/2012 COCOA SEASON.

The costs incurred by all the three cocoa districts as a result of cocoa bags rejected at the port were estimated as below.

Table 4.16 Estimated cost incurred as a result of the bags of cocoa rejected from the districts for the 2011/12 cocoa season.

Estimated cost incurred as a result of the bags of cocoa rejected from the districts

District	Cost per tonne	Number of tonnes (1 tonne = 16 bags)	Total cost (GH¢)
Enchi A	116.21	2625.7	305122.39
Enchi B	118.55	2353.4	278980.84
Sefwi Wiawso	142.41	2490	354548.55

The Sefwi Wiawso cocoa district Enchi A cocoa district was estimated to have made a loss of about Gh¢ 354,548.55 as a result of the bags of cocoa rejected. This was followed by Enchi A cocoa district with Gh¢ 3051, 22.39 and then Enchi B cocoa district with Gh¢ 278,980.84.

4.7: FIELD AND LABORATORY WORKS

Enchi A district recorded the highest quantity of bags (718 tonnes equivalent to 11500 bags) stored outside the shed followed by Enchi B 562 tonnes (9000 bags) and Sefwi

Wiawso district 375 tonnes (6000 bags). These were mainly as a result of the sizes of the sheds available and the quantity of cocoa beans available from the farming season.

Figure 4.15 shows the number of bags of cocoa stored outside in the various warehouses during the 2012 major cocoa season

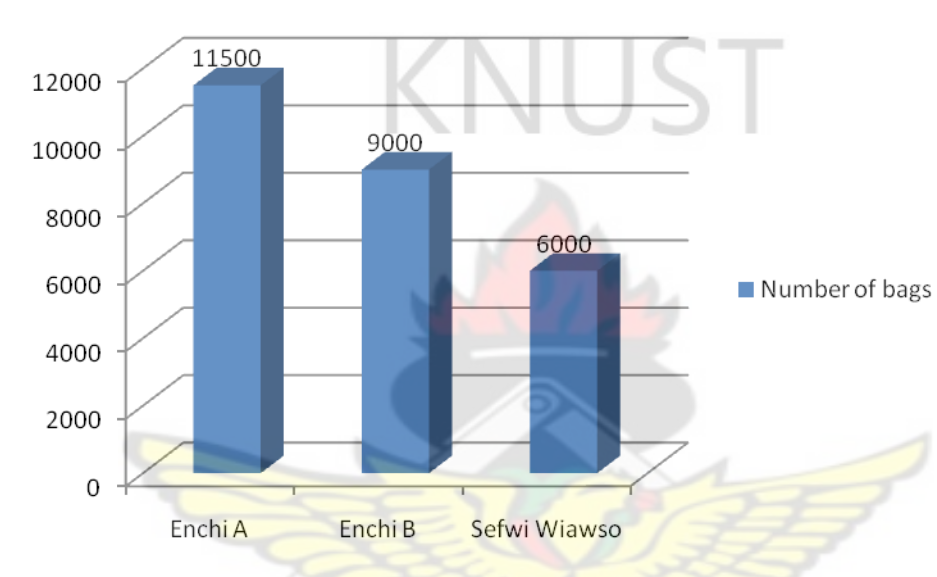

Figure 4.15: Bags of cocoa stored outside the shed during the 2012 major cocoa season

A cross tabulation between the types of defects and the cocoa districts showed the following: Enchi B recorded the highest percentage (72.6%) of mouldy beans followed by Sefwi Wiawso (65.3%) and Enchi A (53.1%). Enchi A recorded the highest percentage (13.9%) of germinated beans followed by Enchi B (10.3%) and Sefwi Wiawso (9.1%). Enchi A also had the highest (15.6%) number of slaty beans followed by Sefwi Wiawso (8.4%) and then Enchi B (7.1%). Enchi B recorded the highest (2.3%) amount of weevil infected beans followed by Sefwi Wiawso (1.8%) and Enchi A (1.5%).

For any other defects, Enchi A recorded the highest with 15.8% followed by Sefwi Wiawso (15.3%) and Enchi B (7.6%).

Table 4.17: Cross tabulation between percentage of defects and cocoa districts

Percentage Defects	**Enchi A**	**Enchi B**	**Sefwi Wiawso**
Mould (%)	53.1	72.6	65.3
Germinated (%)	13.9	10.3	9.1
Slaty (%)	15.6	7.1	8.4
Weevil (%)	1.5	2.3	1.8
Any Other Defects (%)	15.8	7.6	15.3

The statistical value of .021 is less than .05 (95% confidence level). Hence the null hypothesis is rejected and the alternate hypothesis of is accepted. This implies that there is a significant difference between the field and laboratory works (analyzed cocoa samples from depots) and the Takoradi port records data.

Table 4.18 ANOVA table

ANOVA Measure: Type of cocoa defects					
	Sum of Squares	df	Mean square	F - Statistic	Sig
Between groups (Field data and Takoradi port records)	132.253	1	132.253	7.0161	.021
Within groups (Types of defects identified)	94.2490	5	18.8498		
Total	226.503	6			

4.6.1 Personal Observations

It was observed during the interview of the depots keeper across the three districts that with the exception of PBC most of the warehouses were built of either blocks at the base

with woods at the tops or totally made of wood, this creates uncontrolled vents that may serve as openings for insects and rodents and not all but also escape routes for fogged pesticides when depots are fogged by QCC disinfestation teams in the various districts.

Also some warehouses had broken and cracked floors which serve as hiding places for crawling insects in the depots. Poor lighting systems in depots was a common problem among all three districts

It was also observed that most depot keepers in spite of their level of education had little knowledge about pest forecasting and surveillance.

CHAPTER FIVE

5.0 DISCUSSIONS

5.1 INTRODUCTION:

This chapter critically evaluates the findings of the data analysis in line with the objectives of the research study. This is also done in comparison with existing theories, principles and findings from other research studies.

5.2 SOCIO – DEMOGRAPHIC FEATURES OF RESPONDENTS.

Activities of LBCs in the districts were male dominated especially in warehousing due the laborious nature and this may have been the reason why there are few women. Depot keeping goes with produce handling (weighing and stacking) and even though there are produce carriers (depot boys) most LBCs prefer to engage the services of males who may provide help sometimes.

The level of education of depot keepers showed how ready the LBCs are to employ the services of qualified personnel who are easy to be trained. Even though the 3.33% of the depot keepers who had no education could use the measuring scales, they had very little knowledge about recommended storage practices such as pest forecasting and chemical usage for cocoa beans per the quality standards of COCOBOD.

5.3 STORAGE OF COCOA

The use of the whitewash is to ensure cleanliness and control residual infestation of stored cocoa beans in depots/warehouses. (Cocoa industry regulations, 1968.LI.598). The duration for the whitewashing was mainly in the beginning of major seasons as a result of the large sizes of the warehouses and cost of using whitewash. The reasons given for the use of the whitewash is to ensure cleanliness; increase the lifespan of the warehouse and avoid infestation of stored cocoa beans. This indicated that a few of the respondents understood the reason for whitewashing, since whitewashing is meant to reduce residual infestation in the sheds from the previous year's stock and also to give a false illumination in order to reduce insect population.

Eating in warehouses is strictly prohibited but a few employees were sometimes found eating in the warehouses. This practice attracted insects and rodents into the depots. The reasons given for the sweeping were to ensure cleanliness and avoid infestation of stored cocoa beans.

Cocoa Depots are supposed to be kept clean always. Depot sanitation is the first inspection conducted by QCC graders before grading and sealing in any depot (Cocoa industry regulations, 1968.LI.598). From the research only 11.33 % of Depot keeper responded that their depots are swept every day. The reasons given for the sweeping is to ensure cleanliness; and avoid infestation of stored cocoa beans. Sweeping of depots weekly (31.33%) and monthly (8%) as indicated by some depots keepers, might have been some possible causes of the presence of pests in the warehouses.

The large proportion of storing in the open during the peak season in Enchi A cocoa district was primarily due to reduced capacities and/or size of the warehouse facilities which was available and the bumper harvest received annually. Enchi B cocoa district had less of this storage challenge because they had available large capacities of depots as compared to Enchi A and Sefwi Wiawso cocoa

The minimum acceptable capacity for a standard warehouse to be used as a district depot is one hundred metric tonnes whiles that for villages and/or societies is twenty five metric tonnes. From the study, Enchi B cocoa district had the largest average warehouse size of 696.4 tonnes. This was followed by Sefwi Wiawso cocoa district with 620.7 and then Enchi A cocoa district with 395.4 tonnes.

There were instances where cocoa stocks were stored outside the warehouse during the peak seasons without permission from District Quality Control Officers in all the three cocoa districts. Permission is granted for such situation only when request is made by application and the necessary rules and regulations strictly adhered to depot (Cocoa industry regulations, 1968.LI.598 p5). The owner of the cocoa certified to be stored outside the premises of the cocoa storage depot is mandated, at all times to store the produce on double gratings (Doubling of pallets), the top of the stack formed in a conical shape and covered with a rain-proof tarpaulin. Adu (2007) also explained that the smaller the capacities of the warehouses, the higher the impacted on storage, as this constantly leads to storing excess cocoa outside the warehouse during the peak season. This resulted in loss of cocoa as theft cases increased as well as cocoa being destroyed as a

result of moisture build up across all the three cocoa districts. This also caused the development of mould on the beans, a form of loss associated with poor and damp environments being a major form of storage loss among all the three cocoa districts. The development of mould and other mycotoxins on the beans affects the quality by increasing the free fatty acids (FFA) content with an attendant reduction food quality

There were the presences of pests within the warehouses in all the three cocoa districts. These included birds, rodents, lizards and other animals such as snakes, scorpions and frogs this indicates the presence of insects and rodents in the sheds hence the need for regular disinfestations of depots by Quality Control Company in the districts and the take-over centres. Although cleaning of the warehouse is supposedly done on a regular basis, Anang *et al.* (2011) identified that the presence of pests in warehouses as a challenge which have been difficult to control. This might have been as a results of the fact that only a few LBCs (11%) cleaned their warehouses daily as recommended and coupled with the presence of crakes on the floors of most of the depots as observed during the data collection, which served as hiding places for insects in the depots. District officers and depot keepers of LBC's should therefore request for pest control services for their depots when the need arises.

The study, however, revealed that none of the depot keepers in all the three cocoa districts kept agricultural produce and other substances such as cement, kerosene, petrol and/or gasoline and tar in their warehouses.

The techniques for cocoa storage which was identified by all the respondents showed that sealed and unsealed stocks were not packed together. This is because, the LBC's are advised by Quality Control Company to evacuate graded and sealed cocoa to COCOBOD take-over centres as soon as possible whilst the unsealed packs are left in the depots to be graded and sealed.

Adequate spaces were left between cocoa stacks and the walls in all the three cocoa districts. Cocoa stacks were also packed with spaces in between them. Reasons given included providing aeration and easy movement by personnel to check cocoa stocks frequently. It also enables the Quality Control Company Staff to thoroughly access all areas around the cocoa freely, in order to take representative samples from each cocoa bag for quality tests. These practices are in line with some of the good storage practices of cocoa per the cocoa industry regulations decree of 1968 and it shows that LBCs are going by them.

From the survey, it was estimated that LBCs in Enchi B made 7.4% loss of cocoa due to the identified storage challenges which was the highest. This was mainly due to the high insect infestation, rotten beans and rodents' attacks of stored cocoa. This was followed by Sefwi LBCs in the Wiawso with 7.38% loss of cocoa in storage and was mainly due to high incidences of mouldy beans and spillages due to rodents attack of cocoa in storage. Even though LBCs in Enchi A had the least (7.17%) loss of cocoa due to storage challenges, the incidence of theft of cocoa while in storage was found to be very high and this was due to the smaller depot capacities in the districts that induced the storage of

excess cocoa outside depots during peak seasons. A chi-Square report also showed that, these forms of losses significantly contributed to the losses of cocoa beans in storage in all the three cocoa Districts. In addition to that, Symmetric measures of Creamers V showed that there was a strong association of about 65.4% between the challenges affecting storage and its effect on the percentage loss during storage.

5.4 TRANSPORTATION OF COCOA

The common problems faced during transportation included inadequate trucks, unavailability and high cost of fuel, high cost of spare parts and servicing and, poor roads. The reasons for sending cocoa to discrepant shed at take over centres were found to be rain wet cocoa bags oil stains; torn sacks, weight loss and dirty sacks. Transportation issues identified by Vigneri and Santos (2007) showed that the evacuation of cocoa from the farmer through the Licensed buying company (LBCs) to COCOBOD take-over centres have several challenges that lead to the reduction in quality of cocoa. Triana (2003) explicitly identified that cocoa quality is affected when other products are transported together with cocoa stocks. This tends to affect the colour, flavor and taste of the cocoa beans.

These were as a result of truck drivers using damaged/ thorn tarpaulins to cover cocoa in transit as well as use of contaminated trailers.

Most of the respondents(8%) reported it took a month to evacuate graded and sealed cocoa and this is a matter of concern especially during the peak seasons of the year and during the raining season when deplorable nature of some roads makes it impossible for LBCs to evacuate cocoa. The longer the graded and sealed bags of cocoa are kept in the

depots, the more it becomes insect infested. In addition, poor ventilation and storage conditions in some depots made the cocoa mouldy and according to the cocoa industry regulation (1968), cocoa must not be stored under poor ventilation conditions. These lead to rejections at the ports. The best practice as recommended by QCC is immediate evacuation after grading and sealing.

Poor road was identified as a common problem faced during transportation; because of the deplorable state of the Bogoso-Tarkwa road for instance it took majority of LBCs between 1 to 5 days to evacuate cocoa from Enchi to Takoradi port. The average distance LBCs the Sefwi Wiawso cocoa district cover in the evacuation of cocoa passing through Kumasi was about 364 Km and without passing through Kumasi (through Sefwi Diaso-Ayanfuri-Wassa Akropong- Bogosso- Tarwkwa to Takoradi) the average distance was about 219 Km. However LBCs and transporters were forced to use the Kumasi route because of the poor nature of the Sefwi Diaso route. The average distance LBCs in the Enchi A and Enchi B cocoa districts also travel to evacuate cocoa to the Takoradi port was about 213 Km (Distances from.com, 2013). Transportation challenges such as distance covered by LBCs in Sefwi Wiawso cocoa district to evacuate cocoa to the take-over centre contributed to the mean percentage rejection of cocoa at the take-over centre.

A high proportion of respondents from Sefwi Wiawso (14%) admitted that they had carried other goods in addition to cocoa during transportation. This is a bad practice that leads to cross infestation especially when cocoa is transported with other agricultural

produce. Cocoa can also lose its flavor if transported with charcoal (Cocoa industry regulations, 1968.LI.598).

Chi-square established that the identified defects due to transportation challenges (rain-wet bags, dirty sacks, oil satin sacks, thorn sacks and weight loss) significantly contributed the cocoa rejections at the port.

The symmetric measures of Phi and Cramer's V also showed that there was a strong association (about 63.2%) between challenges affecting transportation and their effect on the percentage cocoa rejection at the take-over centre.

5.5 FIELD AND LABORATORY WORKS

The various factors; insect infestation, moudiness, and rodents attacks affecting cocoa in storage and transportation challenges such as rain-wet of cocoa in transit, dirty, torn and oil stained bags including poor roads identified in the research study played a significant role in leading to the loss of cocoa beans.

Cocoa exposed to theft, rain wet, mouldiness, insect infestations and rodent attack were factors that impacted significantly on the quality and postharvest losses of cocoa from these districts according to the research.

LBCs in Enchi A district recorded the highest quantity of bags stored outside the shed 718 tonnes (11,500 bags) followed by Enchi B 562 tonnes(9000 bags) and Sefwi Wiawso district 375 tonnes(6000 bags) and these were mainly as a result of the sizes of the sheds available and the quantity of cocoa beans available from the farming season and it is in agreement with the survey which showed in figure 4.6 that LBCs in Enchi A had the lowest average warehouse capacity of 395.4 tonnes as compared to Enchi B(696.4

tonnes) and Sefwi Wiawso(620.7 tonnes). The effect of this was affirmed by the results of the analyzed cocoa samples, which revealed that, mouldiness of cocoa beans was the predominant challenge of cocoa storage in all the three districts.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The main aim of the research study is to determine warehousing and transportation challenges of LBCs in the cocoa supply industry in Ghana

The following objectives were achieved by the study:

1. identify the storage challenges of LBCs and asses their effect on quality and losses in cocoa from the districts,
2. identify transportation challenges and their effect on the quality and losses of cocoa from the districts as well as
3. estimate the storage and transportation losses incurred due to the identified challenges and their economic values

The findings of the study include the following:

The activities of storage and transportation in the cocoa industry are male dominated with only a handful of females involved due to the laborious nature of the work. The use of the whitewash on the walls was to ensure cleanliness and control residual infestation of stored cocoa beans. The duration for the whitewashing was mainly in the beginning of major seasons as a result of the large sizes of the warehouses and cost of using whitewash. Eating in warehouses is strictly prohibited however few employees were eat in the warehouses. This practice negatively affected sanitation in the shed and consequently attracted insects and rodents into the depots. The presence of pest such as birds, mice and lizards in the depots contributed to cocoa infestations hence rejections at the port. Generally cleanliness was found to a challenge among all the three cocoa

districts and this also lead to the presences of pests in the depots since only a few depots were cleaned daily as recommended.

The sizes of the warehouses affected the frequency of the removal of cobwebs. Agricultural produce and other substances such as cement, kerosene, petrol and/or gasoline and tar were not kept in any of the warehouses.

There were instances where cocoa were stored outside the warehouse during the peak seasons This was mainly due to small depots capacities that could hold all cocoa purchased during bumper harvests leading to high loss of cocoa due to theft. LBCs in Enchi A cocoa district had the smallest storage capacities on the average, followed by LBCs in the Sefwi Wiawso district with Enchi B having the largest depot capacities on the average

The forms of storage losses included rotten beans; mouldy beans; spilled beans rodents, cocoa beans infested with insect and theft.

The reasons for which cocoa beans were rejected at take over centres were rain wet cocoa bags due to the use of torn tarpaulins use to cover cocoa in transit, Torn sacks due to poor handling and stacking, weight loss due to the exposure of loaded trucks to severe dry weather conditions, Oil stains and Dirty sacks as a result of the use of tainted trailers to carry cocoa. The common problems faced during transportation were inadequate trucks

during unavailability and high cost of fuel; high cost of spare parts and servicing and; poor roads.

The average distance LBCs the Sefwi Wiawso cocoa district cover in the evacuation of cocoa passing through Kumasi about 364 Km. Without passing through Kumasi (through Sefwi Diaso- Ayanfuri-Wassa Akropong- Bogosso- Tarwkwa to Takoradi) the average distance would have been 219 Km but LBCs and transporters are forced to use the Kumasi route because of the poor nature of the Sefwi Diaso route. Whilst the average distance LBCs in the Enchi A and Enchi B cocoa districts travel to evacuate cocoa to the Takoradi port 213 Km (Distances from.com, 2013). The longer distance LBCs in Sefwi Wiawso cocoa district traveled to evacuate cocoa to the take-over centre contributed to the highest cost incurred as a result of the identified challenges. This made is more expensive to transport a tonne of cocoa to from Sefwi Wiawso the port as compared to Enchi A and Enchi B cocoa districts

Sometimes, transporters were found to have carried other goods in addition to the cocoa. The other goods generally carried include agricultural produce (food stuffs) and charcoal. This resulted in dirty sacks, oil stains and thorn sacks of the cocoa bags. Transporters gave reasons such as providing help for stranded farmers and other passengers; a means of making some extra money; and doing friends and family members a favour. Enchi B cocoa district had the highest mean percentage rejection of cocoa as a result of transportation challenges with 8.55% rejection of cocoa sent to the port. This was followed by Enchi A with 7.8% cocoa loss. Sefwi Wiawso had the least mean with 7.6%.

The reasons for the rejected cocoa include not thoroughly dried (NTD), cocoon infestation, high moisture content, short weight, adulteration, wet bags, oil stained bags, weak sewing and burst bags.

The study also revealed that estimated losses due to the identified storage and transportation challenges by the LBCs in the Sefwi Wiawso cocoa was valued at Gh¢ 354,548.55 for the 2011/2012 cocoa season. Followed by Enchi A making losses valued at Gh¢ 305,122.39 and then Enchi B cocoa district making losses valued at Gh¢278,980.84.

A Chi-Square report showed that the various factors affecting storage and transportation identified in the research played a significant role in loses of cocoa beans.

The significant difference between defects from field and laboratory work (analyzed cocoa samples from depots) and the Takoradi port records on cocoa rejections implied that, the various factors affecting cocoa in storage; insect infestation, moudiness, and rodents attacks and transportation challenges such as rain-wet of cocoa in transit, dirty, torn bags including poor roads as identified in the research study contributed significantly to the losses of cocoa beans.

The field work also revealed that LBCs in all the three the districts stored large quantities of cocoa ouside their depots during the peak seasons because of the smaller capacities of warehouses they used.

This practice exposed cocoa to theft, rain wet, mouldiness, insects infestations and rodent attack of which were factors that affected the quality and postharvest losses of cocoa from the districts significantly according to the research.

From the study, it could be said that addressing the identified storage and the transportation challenges these three cocoa districts alone could increase Ghana's cocoa output by about 7,469 tonnes per season.

6.2 RECOMMENDATIONS

The following recommendations are made based on the findings of the study:

The capacities of the warehouses for the Licensed Buying Companies in the three cocoa districts (Enchi A, Enchi B and Sefwi Wiawso cocoa districts) must be increased to avoid the storage of cocoa outside the warehouses during the peak season. LBCs with smaller capacity warehouses can set up multiple warehouses at different locations within districts to store cocoa as their markets share increases. This will help avoid the storage of cocoa outside depots during peak seasons and also theft associated with it.

Quality Control Company of COCOBOD should be able to operationalize a system to ensure that depots are kept clean at all times. This could be in the form of a check list for inspection of warehouse prior to grading and sealing. This will help circumvent the infestations of cocoa in storage due invasion of pests such as birds, rodents, insects, snakes and scorpions and to promote food safety.

COCOBOD should support Management of the Licensed Buying Companies (LBCs) to train its Depot keepers on the recommended warehousing management practices and their impact on cocoa quality and food safety including proper storage, and basic pest forecasting techniques to avoid these rejections and also enable COCOBOD meet and possibly exceed its shipping targets.

The Government through the District Assemblies must ensure that feeder roads in cocoa districts are constructed, roads in deplorable conditions and weak wooden bridges repaired since cocoa plays a vital role in the country's economy.

Quality Control Company should come out with a HACCP plan for the transportation of cocoa from up-country as a proposal to COCOBOD approval. There is the need for QCC to inspect, certify and issue a transportation certificate to all trucks used to transport cocoa in Ghana to ensure food safety and also serve as assurance to consumers (our buyers). If implemented Officers up country would check tarpaulins for possible leakages avoid incidences of rain wet bags during transportation, inspect trailers for any bad stink or stain. In addition to these, the road wealthy (maintenance culture), insurance coverage of trucks will be inspected and the time it will take the truck in transit to reach the point of destination be stated.

6.3 AREAS OF FUTURE STUDIES

Further research can be conducted to find out what measures COCOBOD and other stakeholders are putting in place to solve these challenges impacting storage and transportation of cocoa in Ghana.

This research can be replicated in the other four cocoa regions to assess the postharvest situation in other districts.

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Appendix

1. **Sample Questionnaire**

APPENDIX: QUESTIONNAIRES

QUESTIONNAIRE
KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Questionnaire on "Assessment of storage and transportation challenges in the Cocoa Industry- The Case Study of Enchi A, Enchi B and Sefwi Wiawso cocoa districts" The aim of the questionnaire is to help in gathering the responses to facilitate a research on assessment of storage and evacuation challenges in the cocoa industry as part of the requirement for the award of MSc Postharvest Technology in Institute of Distance Learning, KNUST. Please tick when appropriate and fill in the spaces provided. This research is mainly an academic work, and as such your responses will be treated with utmost confidentiality. Your time and attention spent on these questions would be very much appreciated.

Questionnaire on Assessing storage and transportation challenges of cocoa licensed buying companies at Enchi A, Enchi B and Sefwi Wiawso cocoa districts in the Western Region.

District…….. Position of respondent……

Capacity of depot in tonnes……..

Educational level A) Middle Sch/JHS B) SHS C Tertiary D) None

Storage

1. Do you check for incidences of roof leakages? A) Yes B) No

2. How often do you whitewash and why?
.....

3. Do workers eat in the warehouse? a. Yes b No

4. How often do you sweep the warehouse? a. Daily, b. Every other day. C. Weekly.

D other…….

5. How often do you remove cobwebs? A) Weekly B) Monthly C) As and when noticed. Other…….

Why?
……
…….

6. Do you store other agricultural produce in the Depot? A) Yes B)No

If yes which other produce?

.....
.....

7. Is there water entering under doors and through window? A) Yes B) No

8. Do you open windows and doors for ventilation even when there is no work to be done in the depot? A) Yes B) No

9. Do you leave space between the wall and produce? A) Yes B) No

If Yes Why……

10. Do you pack both sealed and unsealed cocoa together? A) Yes B) No

Give reasons for answer

…..……
……

11. Do you keep empty sacks in the Depot? A) Yes B) No

12. Do you keep Substance such as Cement, kerosene or Tar in the Depot?

A) Yes B) No

13. Have there been instances where cocoa is stored in the open or lean-to heds in your depot during peak seasons? A) Yes B) No

If yes was the District quality control officer notified in writing? A) Yes B) No

14. Is there evidence of nesting, feathers or bird's droppings? A) Yes B) No

15. Do you see any other animals/pests? A) Yes B) No

If yes which ones: A) Lizards B) Mice C Others ……..

16. Do you see any evidence of gnawed bags gratings or beans? A) Yes B) No

17. Do you see any insects in the depot? A) Yes B) No

18. Do you request for fogging? A) Yes B) No

If yes how often? .....

19. In your own point of view are there any other challenges facing your company in the storage of cocoa in the depot? Yes No

If yes what are they?

……
……
……
……

20.In your own opinion what do you think can be done to solve some of the storage problems?

……
……
……
……

21. What has been done to address these storage challenges?

……
……
……

22.What is the percentage loss of cocoa beans during storage (How many bags of cocoa are lost per tonne due to storage problems per crop season, how many tonnes can u store per crop season)?

A) <5% B) 5 - 10% C) 10 - 20% D) <20%

23. What are the forms of storage loss to cocoa beans experienced?

A) Rotten beans B) Mouldy beans C) Attack by rodents D) Insect infestation. Others (theft)……

PRIMARY EVACUATION

24. What are the major problems that you are facing in the evacuation of cocoa from the societies to the depot?

……
……
……
……

22. Do these problems occur every year? A) Yes B) No

23.What measures have been put in place to either eliminate or minimize the transportation problems you are facing?

……
……
……
…….

25. In your own view what do you think can be done to solve some of the problems, apart from what the LBC's management had put in place?
……
……
……
……

26. After grading and sealing how long does it take for your produce to be evacuated?

A) Within a week B) Two- Three weeks C) One month D) over one month

27.Have there been instances where cocoa from your depot have been sent to discrepant shed at the take -over centre as a result of transportation inefficiencies?

A) Yes B) No

28. If yes, what was the reason for the rejection?

A) Rain wet B) Dirty Sacks C) Oil stains D) thorn sacks.

Others……
……

27b.Do these rejections occur every year? A) Yes…..B) No……

29. What measures have been put in place to either eliminate or minimize these rejections?
……
……
……

30. How long does it take beans to be stored prior to transportation?

A) Within a week B) between a week and a month C) 1 - 6 months D) more than 6 months

31 Identify the commonest problems faced during transportation

A)poor roads B)High cost of spare parts and servicing

C)Availability and cost of fuel D)other State……

32. What is the average distance travelled in transporting cocoa?

A) <50 km B) 50 - 100km C) 100 - 200km D)>200km

6. What is the average time spent in transporting the cocoa?

A) <1 day B)1 - 5 days C)6 - 10 days D) >10 days

33. Do you sometimes carry other goods in addition to cocoa during transportation?

33b. If yes what other goods?.....

34. What is the percentage loss of cocoa beans during transportation?

A) <5% B) 5 - 10% C) 11 - 20% D) >20%

35. How is cocoa protected during transportation?.....

SECONDARY EVACUATION

1. How long have you been in cocoa evacuation operations? A) 1-5 yrs B) 6-10yrs C) 11-15yrs D) Above 15years.

2.In your own point of view what are the major challenges that affect the quality of cocoa during evacuation from up-country to the take –over centres?

……
……
……
……

3.In your own opinion what do you think can be done to improve upon cocoa evacuation operations from up-country to the take-over centres

……
……
……
……

4 Identify the commonest problems faced during transportation

A)poor roads B)High cost of spare parts and servicing C)Availability and cost of fuel D)other
State……

5. What is the average distance travelled in transporting cocoa?

A) <50 km B) 50 - 100km C) 100 - 200km D)>200km

6. What is the average time spent in transporting the cocoa?

A) <1 day B)1 - 5 days C)6 - 10 days D)>10 days

7. Do you sometimes carry other goods in addition to cocoa during transportation?

7b. If yes what other goods?.....

8. What is the percentage of cocoa beans rejected at the TOC as a result transportation inefficiencies? (how many bags of cocoa out of the 600 bags per truck are rejected due to transportation problems on the average)?

A) >5% B) 5 - 10% C) 10 - 20% D) <20%

9. How many trucks do you evacuate to the port per crop season?.....

10. How is cocoa protected during transportation?.....

2. Anova table

ANOVA Measure: Type of cocoa defects					
	Sum of Squares	Df	Mean square	F - Statistic	Sig
Between groups (Field data and Takoradi port records)	132.253	1	132.253	7.0161	.021
Within groups (Types of defects identified)	94.2490	5	18.8498		
Total	226.503	6			

3. Results of cut test analysis of cocoa samples from the three districts.

Defects	**Enchi A**	**Enchi B**	**Sefwi Wiawso**
Mouldy	7243	15231	11301
Mould (%)	53.1	72.6	65.3
Germinated	1897	2167	1569
Germinated (%)	13.9	10.3	9.1
Slaty	2134	1498	1459
Slaty (%)	15.6	7.1	8.4
Weevil	210	472	319
Weevil (%)	1.5	2.3	1.8
Any Other Defects	2152	1600	2654
Any Other Defects (%)	15.8	7.6	15.3

Storage challenges that affected cocoa quality and losses

Plate 1 : Storage of cocoa and other substances(fertilizer) in the same depot

Plate 2: storage of cocoa with rice bran

Plate 3: **Storage of cocoa outside depots**

Plate 4: Storage of cocoa outside depots Covered with damage tarpauline

4. Transportation Challenges that affected Cocoa Quality and Losses

Plate 5: Poor road networks- A truck carrying cocoa stucked in mud(Sefwi Wiawso/Bekwai - Asankrangwa road).

Plate 6: Transporting cocoa without cover.

Plate 7: Poor covering of cocoa with tarpaulin.

Plate 8: Transporting cocoa without cover.

Plate 9: Parcels of rain-wet cocoa rejected at the port.

Plate 10: Parcels of torn/bust bags of cocoa rejected at the port