CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE
Faculty of Economics and Management
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DIPLOMA THESIS

Economic Analysis of Mechanized Cocoa Production: A study case of Amenfi west, Ghana

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DIPLOMA THESIS ASSIGNMENT

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Economic Analysis of Mechanised Cocoa Production: A study Case of Amenfi West, Ghana

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Objectives of thesis

Main objectives of the thesis are as follows;

1. To analyse the economic importance of cocoa production in the Amenfi West district
2. To identify the factors affecting cocoa production in the Amenfi West district
3. To assess the various programmes and policies by the governments to improve cocoa production in the country

Research hypotheses:
1. Mechanized cocoa production in Ghana has been a potential economic recovery sector for the country over the years.
2. Various cocoa sector revival programmes have comparatively enhanced productivity over the years.
3. Cocoa production in Amenfi West is faced with potential problems affecting the rate of productivity.
2.2 Methodology

Methodology

Quantitative and qualitative approaches for the analysis of data will be applied. Through the use of the interview guide, semi structured questions will be formulated and administered to 50 participants in the Amenfi West district (study area) of the central region of Ghana. 10 participant in each of the five enclaves were selected to meet the objectives of the thesis. The thematic content analysis will be adopted to analyse data collected from the questionnaires.

The proposed extent of the thesis

60 – 80 pages

Keywords

analysis, agriculture, cocoa, mechanised production, economy, Ghana, Africamechanised

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Recommended information sources

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Declaration

I hereby acknowledge that I have worked on this diploma thesis titled '' Economic Analysis of Cocoa Production; A case study of Amenfi-West, Ghana'' by myself and all used resources are included in the References and Appendix section.

In Prague on …….. Solomon Boafo

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Economic Analysis of Mechanised Cocoa Production: A study Case of Amenfi west, Ghana

Abstract

Cocoa production is the main contributor of the Ghanaian economy. It contributes immensely to the economic. It is also the highest contributor to the GDP growth. It has seen significant growth in the last two seasons and forecast suggests that it will do well in the next season.

However, the production is threatened by certain factors that include climate change, disease and pest, mechanization, financial constraint on the sides of the farmers and lower producer price. This thesis looked at the SWOT analysis of cocoa production and factors that affects high Production.

Through the use of focus group interviews and qualitative analysis of the contribution made by government and other NGOs, it was identified that the environment provides some form of advantage in terms of land availability. Mechanization will increase the yield of the cocoa production. Among the weakness found was the lack of readiness by the farmers to adapt to technological change, pest and diseases and, climate change.

The thesis recommends that government inculcating mechanized farming and adaptation of new technologies will boost the Cocoa production.

Keywords: analysis, agriculture, cocoa, production, economy, Ghana, Africa.

Ekonomická analýza mechanizované produkce kakaa: studie případu Amenfi západ, Ghana

Abstrakt

Produkce kakaa je hlavním přispěvatelem ghanské ekonomiky. Nesmírně přispívá k ekonomice. Je také největším přispěvatelem k růstu HDP. V posledních dvou sezonách došlo k významnému nárůstu a prognóza naznačuje, že se v příští sezoně povede dobře.

Produkce je však ohrožena určitými faktory, mezi něž patří změna klimatu, choroby a škůdci, mechanizace, finanční omezení na straně zemědělců a nižší cena producentů.

Tato práce se zabývala SWOT analýzou produkce kakaa a faktory, které ovlivňují vysokou produkci.

Pomocí rozhovorů s cílenými skupinami a kvalitativní analýzy příspěvku vlády a dalších nevládních organizací bylo zjištěno, že životní prostředí poskytuje určitou formu výhody, pokud jde o dostupnost půdy.

Mechanizace zvýší výnos produkce kakaa. Mezi zjištěné slabiny patřil nedostatek připravenosti zemědělců přizpůsobit se technologickým změnám, škůdcům a chorobám a změně klimatu.

Práce doporučuje, aby vláda zavádějící mechanizované zemědělství a přizpůsobování nových technologií podpořila produkci kakaa.

Klíčová slova: analýza, zemědělství, kakao, výroba, ekonomika, Ghana, Afrika

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List of abbreviations

AIPC	Association of cocoa processing industry
COCOBOD	Ghana cocoa board
CAN	Cocoa association of Nigeria
CHED	Cocoa health extension division
CMB	Cocoa marketing board
CRIG	Cocoa research institute of Ghana
CMC	Cocoa marketing company
EU	European Union
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agricultural organization statistics
GSS	Ghana statistical service
GDP	Gross domestic product
HS	Harmonised system
IMF	International monetary fund
RAP	Rural participatory appraisal
PPP	Purchasing power parity
UN	United Nation
US	United States

CHAPTER 1: INTRODUCTION

1 Introduction

Cocoa production has been the mainstay of the Ghanaian economy before the attainment of independence in 1957. Though, the crop is not native to the country its production has assumed prominence among indigenous local farmers in the country (Roling, 2010). Cocoa is cultivated in six out of 16 regions as major cash crops and as a subsidiary crop in the remaining ten regions (Tawiah, 2015).

In 2018 and 2019 harvest seasons, the country was estimated to have produced about 900,000 tons of cocoa beans and 905,000 tons in the years 2017 and 2018 which represents a slight fall in production in 2016 and 2017 (Shahdandeh, 2019). This figure according to the report is a significant decrease in production from 969,000 tons in 2016 and 2017 harvest seasons. In spite of the unsteadiness in cocoa production in the country, the industry has witnessed massive production over the years boosting the country's agricultural sector (FAO, 2018)

According to the Ghana Cocoa board (Cocobod) (2016), the industry employs roughly 800,000 farmers distributed across all the farming regions in the country. Cocoa production in 2014 contributed over 2 billion USD in foreign exchange per annum and held the lion's share in its contribution to governments' revenue and overall Gross Domestic Product (GDP) over the years (Ghana Cocoa Board, 2017).

Successive governments in Ghana, not excluding the colonial governments' have had their economies driven by cocoa production; it was the major source of public revenue during the colonial episodes (Manley, 2012). As an agricultural based economy about 60% of the economically active citizens are engaged in farming as their main occupation and 70 per cent out of the 60 are traditional cocoa producers (Kovalli & Vigneri, 2017). According to Mattyasovzky (2017), the engraving of cocoa pod on the currency of Ghana testifies to the undeniable importance of the beans to the economic advancement of the country.

Although, the cocoa bean was introduced into the country from South America, majority of global cocoa beans production is attributed to Africa (Bauer, 2016). It was reported that in 2017 and 2018 Africa's cocoa bean production amounted to approximately 3.5 million tons of the global share. Ghana is one of the two leading producers of cocoa on the global scale after Ivory Coast (Shahdandeh, 2019). This position has been attributed to numerous far reaching and far sighted programmes designed and implemented by the country under the auspices of the Ghana Cocoa Board, these commitments evident the emerging competitive urge of the country in the global cocoa market. The need to analysis the economic dividends consequent to the state's commitments is vital in determining the relevance of these programmes.

1.1 Information about Ghana and its economic standing

Ghana is geographically located in the West Africa. As a former British colony its official language is English, the country is mostly regarded as part of the Sub-Saharan African countries, a term used to represent 46 out of the 54 African countries that are fully or partially located south of the Sahara (UN, 2010). Ghana had independence from the British in 1957 and was declared a republic in 1960. The country is a constitutional democratic country.

The country is for the purpose of administration divided into sixteen regions, as a unitary state the administrative capital is Accra, which doubles as the seat of government and commercial capital. Ghana is a multi-ethnic and multi-cultural country with many different languages spoken by different tribes and ethnic groups. The Ghanaian economy is endowed with numerous natural resources, located across the geographically spectrum of the country, with each of the sixteen regions boasting of one natural resource or more. Among some of the major resources base of the country include manufacturing and exportation of digital technology products, automotive and ship building and exportations. The country is also noted for the exportation of resources such as hydrocarbons and industrial minerals. These trading activities contributed immensely to Ghana being one of the countries in West Africa with the highest Gross Domestic Product (GDP) per capita (Worldfolio.co.uk, 2017).

Ghana became one of the fastest growing economies in the World in 2011 due to its policy of debasement and since then the country has maintained a steady economic growth (Tawiah, 2016). With a population of 29.767.108 24% of the country's population is

unemployed (World Bank, 2018), Ghana's GDP nominal is pecked at $65.518 billion ranking 73rd in the World and its GDP PPP is $191.862 billion ranking 68th in the World (International Monetary Fund, 2018).

As an agrarian based economy, the GDP growth of the country over the years is 8.1% in 2017, 6.3% in 2018, 7.0% in 2019 and 6.8% in 2020 (World Bank, 2020). The country's exportations include oil, gold, cocoa, timber, tuna, bauxite, aluminium, manganese ore, diamonds and horticultural products. Exports contribution to the overall country's financial wealth amounted to $13.84 billion in 2017 alone (Central Intelligence Agency, 2019).

Ghana's main export partners include India, United Arab Emirates, China, Switzerland, Vietnam, and Burkina Faso. Capital equipment, refined petroleum, pharmaceutical products, food stuffs and automobile are among import goods. Main import partners are China, United States, United Kingdom, the EU, Belgium, and India (Central Intelligence Agency, 2019).

In spite of the discovery of oil, the agricultural sector remains the backbone of the country's economy. According to Partnaire Fondateur D'economies Africaines, (2017), agriculture accounts for about 20% of Ghana's Gross Domestic Product (GDP) and employs 44.7% of the working class. The country has five agro-economic regions corresponding to the geographical regions. The diverse nature of the country's economy provides enormous benefit to the country from dynamic agricultural activities. At least 65% of the country's land is arable and it's dedicated to cultivation of various crops, including many cash crops, chief among them is cocoa which accounts for 30% of exports including oil (Partnaire Fondateur D'economies Africaines, 2017).

In fact the dominant agriculture sector is cocoa production, making Ghana the second largest producer in the World after Ivory Coast, the two accounts for 70% of the global market share (Partnaire Fondateur D'economies Africaines, 2017). Cocoa production is dominant in six regions. The country consistently produces over 850 000 tonnes of beans in the event of bumper harvest. Although, the country is debt-ridden the political stability over the years has inspired massive economic transformation from a military-run economy to a more open prosperous economy characterised by labour freedom, monetary freedom, sound

governance and a highly competitive market since the beginning of the fourth republic in 1992 (The Heritage foundation, 2019)

1.2 Problem statement

Cocoa is used in the production of several products across the World; its use is not limited to consumption alone but in the production of medicines and body lotions by people of all backgrounds. Cocoa remains one of the major commodities listed on numerous commodity markets. It is widely grown in tropical continents. The major production countries include Indonesia, Brazil, Peru, Argentina, Nigeria, Ghana, Cameroun, Ivory Coast, Papua New Guinea and Ecuador (Shahdandeh, 2019). However, Ghana follows Ivory Coast as the leading producers in the World. .

The concept of value chain is that products go through various stages often through the channel of cross border networks through what is commonly referred to as the global production network, which explains the nexus of interconnectedness of functions, operations and transaction through which a specific product of service is produced, distributed and consumed. In short, it is the geographical distribution of the roles or activities for production of goods and services across national boundaries.

What this sharp shift in paradigm means is that, cocoa producing countries should strive to improve upon their production capacities by way of remaining competitive in the global production network of cocoa through the addition of values to the raw beans.

The sector is highly competitive due the application of modern technological knowledge in production, distribution and supply and the threat of substitute good due to technological advancement, which has the propensity to undermine global demand for the commodity. Governments of various cocoa producing countries have embarked on major transformation programmes of the sector such as cocoa technology to mechanize smallholder and large owners of farms (Nieburg, 2015).

Ambitioned to boost and enhance its potentials and importance in the global cocoa production, the Ghana Cocoa Board (Cococbod) under the mandate and support of the Ghana government have proposed and implemented a lot of beneficial and productive programmes

and projects in the cocoa production industry. The star of these policies is the mechanization of the industry.

One of the major developments in the cocoa industry is the era of mechanization. Cocoa production in Ghana has not being immune from natural and artificial destructive forces, yet, the industry proves resilient in the face of all these forces potent to supervise the collapse of the industry. The body responsible for managing the industry on behalf of the state, the Ghana Cocoa Board (Cocoa board) has made significant strides in human and financial commitment to ensure that cocoa production as it has been the backbone of the country's economy since independence maintains its enviable status domestically and internationally.

The application of technology, though, comes with enormous financial cost to the state; successive governments have injected huge resources into the industry in the form of mechanization and education. How then have these commitments by the cocoa board been economically prudent to the state? This work considers the various mechanized programmes embarked on by the government of Ghana in improving the production of cocoa in the country by analysing the case of Amenfi West, and proceed to assess the economic dividend accrued as a result.

CHAPTER 2: OBJECTIVES AND METHODOLOGY

2 Objectives/Aims

Main objectives formulated to guide the thesis are as follows;

1. To analyse the economic importance of cocoa production in the Amenfi west district
2. To identify the factors affecting cocoa production in the Amenfi west district
3. To assess the various programmes and policies by the governments to improve cocoa production in the country
4. To identify the determinant factors of mechanical efficiency in cocoa production

2.1 Hypothesis

1. Mechanized cocoa production in Ghana has been a potential economic recovery sector for the country over the years.
2. Various cocoa sector revival programmes have comparatively enhanced productivity over the years.
3. Cocoa production in Ghana is faced with potential problems affecting the rate of productivity

2.2 Methodology

The researcher employed quantitative and qualitative approaches for the analysis of data. Through the use of interview guide, semi structured questions were formulated and administered to 50 participants in the Amenfi West district (study area) of the Western region of Ghana, to meet the objectives of the thesis. Thematic content analysis was adopted to analyse data collected from the questionnaires.

The qualitative analysis allowed the researcher to access and analyse secondary information from relevant and reputable domestic state and international institutions and organizations such as Ghana; The Ghana Statistical Service (GSS), Ghana Cocoa Board (Cocoa board), World Bank, International Monetary Fund (IMF), Food and Agriculture

Organization (FAO), Food and Agricultural Statistics (FAOSTAT) and reports from relevant state's commission of inquiry on cocoa production and related issues.

A bottom down approach to development tools such as; participatory rural appraisal (PRA) was adopted as part of the researchers' interaction with the respondents; this approach took the form of interviews and the use of focus group discussion checklist.

Budgeting technique: the formula for budgeting allowed the researcher to compute total cost of mechanized inputs by the farmer, total revenue and profit for farmers using data collected through the research instrument.

Profit was determined adopting the following formula. $\Pi = TR - TC$, $TC = TVC$. $\Pi = P*Q - TVC$. Where Π= profit per 5 acres, TR = total revenue per ha, TC= Total cost, P= price per bag of cocoa on the local market, Q= quantity of output per bag of cocoa and TVC = total variable cost

Linear Regression (ordinary least squares, OLS): The researcher base the profitability analysis on one year production period per acre of cocoa farm. Cost/benefit analysis was determined by profitability.

Relationship used was cost/benefit ration = $\Sigma B1, \Sigma C1$; where B1 = total revenue of individual farmer per acre, C1 = total cost of individual farmers interviewed per acre.

The model employed for affecting profitability of maize production is a linear regression (OLS), where, $P = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \beta5X5 + e$. P = Profitability, X1 = Cost of seed, X2 = Cost of fertilizer, X3 = Labour Cost. X4 = Famers age and X5 = Education level of farmer e = stochastic term.

The researcher also relied on information from reputable journal and peer review publications.

2.3 Justification

The study area for the work is one out of the twenty-four districts located in the western region of Ghana. As one of the farming hubs in the country, most of the farmers are peasant subsistent, with only a handful of them in commercial scale farming. The districts are generally low income earners since in Ghana farming is considered an occupation for the poor, this reflects in the low standard of living of its people.

Due to the importance of the region as a major farming area to the country, contributing hugely to the country's economic advancement, successive governments have made pertinent, real commitment to raising the economic standard of the region and the people therein. Government supported programmes and projects intended to uplift the economic and social image of the country cut across all the sixteen regions of the country, particularly focusing on rural regions such as the western region. Among some of these programmes include planting for food and jobs, mass cocoa spraying and free Senior High Schools, the rationale behind these policies is to developed rural communities which according to Scherr, (1995) is foundational to industrialization.

The government of Ghana in partnership with private companies have embarked on massive water production projects in rural communities in the western region, the intention is to sustained lives of people by mitigating rural-urban drift in order to improve on farming in the region, most especially cocoa farming. It must be pointed out that due to the undisputable importance of cocoa production to the country's economic aspiration and the fact that western region is indispensible in cocoa production the government of Ghana over the periods have injected enormous resources into cocoa production in the region (Bray, 2014). Countless numbers of programmes that have been designed and implemented in the various cocoa producing regions are ambitioned to boost and bolster cocoa production with real dividend expected to be reaped by the government and farmers.

One major comprehensive programme designed to improve cocoa in West Africa was strengthening innovations and technology dissemination for sustainable development in cereals, cocoa and coffee value chains in Western and Eastern Africa (Obeng-Ofori, Opare & Agyei-Ohemeng, 2014). As part of utilizing its share of the programmes the government of Ghana channelled its share of the sponsorship package to the western region, known to be the

powerhouse of cocoa production in the country. This agricultural friendly programme introduced new form of technology and enhanced existing technological acumen of the countries involved (Obeng-Ofori et al, 2014)

Various governments have realized the economic importance of cocoa production, therefore hope to accrue the economic importance of their investments. As a dominant cash crop in Ghana, cocoa has been the mainstay of the Ghanaian economy for many years, and a constant and reliable contributor to the country's GDP over the years (COCOBOD News, 2010) and approximately 11.5% to agricultural GDP (SRID MOFA, 2010). The introduction of mechanization to the sector means improvement in production. The Ghanaian government is highly involved at all level of research, production and export according to Bray, 2014).

The discovery of oil in commercial quantities in Ghana portend a great doom for the cocoa industry, many scholars have criticized governments for abandoning the agricultural sector upon discovery of oil in 2007. This criticism from technocrats coupled with outrage of public condemnation rekindled government efforts and redirected its attention to the cocoa industry, thereby making huge and renewed commitment to the industry through technical, technological and research as well as financial contributions to the sector. It is however imperative to outline the causes of the swift change in governments' outlook towards the cocoa industry and highlight the specific strategic policies towards revamping the seemingly abandoned industry.

The literatures on cocoa production in Ghana focus on the economic importance to the country on a whole, this thesis deviate vastly from the methodologies used by a chunk of the literatures reviewed, by meticulously juxtaposing the various programmes and projects by governments and highlighting the economic outcomes strictly consequent to the strategic programmes.

The study will make informed recommendation on the strength of data collected and analysed. The findings thereof will add to the corpus of knowledge on the economic importance of cocoa production to a country. To the country, the findings will aid governments to improve production by recognizing militating factors against cocoa production and therefore mitigating them. Cocoa farmers and private investors will also benefit immensely through opportunities offered them to externalize their grievances as part

of the interview, the thesis provides opportunity for farmers to have their problems published, thereby attracting governments and other relevant stakeholders' interest in the bid to improve the system of mechanized cocoa production.

2.4 Study Area

Amenfi West municipal is geographically located in the Western Region of Ghana. The municipal is one of the 14 Municipal metropolitan and district assembly (MMDAs) in the region (Statoids, 2017) Amanfi West Municipal is located between Latitude 400'N and 500 40'N and Longitudes 10 45'W and 20 10'W (Ghana Statistical Service, 2019).

The municipality has a population of 92,152 with a total land area of 1.448.56 square kilometres according to the last population and housing census in 2010 (Ghana Statistical Service, 2019). The municipality is bounded to the west by Sefwi-Akontombra district and the Aowin municipal, the south by Jomoro Municipal, Ellembelle district and Nzema East municipal, the east by Prestea Huni-vally municipal and Amenfi central district. Its administrative and commercial capital is Asankragwa. The capital serves as a social, economic, commercial, trade and religious centre for towns and villages within and around the municipality (Ghana Statistical Service, 2019b)

Wassa Amenfi municipal is a predominant farming community; the major occupations in the municipality are farming, fishing and animal husbandry. It is among the wettest part of the country, recording an average rainfall of 1600 mm per year according to Ghana Meteorological Agency, (2018), making the area highly arable and supportive of traditional and tropical food crops such as coffee and cocoa. The municipality is among the major hubs of a variety of agricultural activities in the country. It is of economic importance to the country since it is considered a reliable breadbasket for the country. Among the various crops cultivated in the municipality include rice, cassava, yam, cocoyam and plantain. Coffee, oil palm, coconut, rubber and cocoa are the commercial crops cultivated in the municipality with cocoa being the chief among them (Ministry of Food and Agriculture, 2018).

Figure 1: Map of Western Region indicating Wassa Amenfi West municipality.

Source: Ghana.png.com (2018)

2.5 Data type and collection procedure

The researcher relied on primary and secondary sources of data for the work. Again qualitative and quantitative approaches were employed for the analyses and explanation of information assembled from the foregoing sources of data. The use of interview guide was purposed at gathering primary data from the respondent farmers in selected communities in the study area (Amenfi west municipal).

Among the primary data gathered were the socio-economic characteristic of the respondents, their demographic distribution, sex and age. Field information such as; types of farming inputs regularly used, output of harvest (yields per seasons), variety of planting materials (cocoa beans), cost of production, government's contribution to production, sources and types of incentives, constraining forces against successive farming seasons, and the benefit derived from cocoa production.

Secondary data were obtained from state institutions relevant for cocoa management such as the Ministry of Food and Agriculture, Ghana Cocoa Board (Cocobod), Cocoa Research Institute of Ghana (CRIG), Ghana Statistical Service (GSS) as well as other reputable international bodies such as the World Bank, International Monetary Fund (IMF), Food and Agric Organization (FAO), and Food and Agriculture organization statistics (FAOSTAT). Secondary data from existing work on mechanized cocoa production in Ghana were deemed reliable sources of information.

The use of a bottom-up approach such as the rural participatory appraisal (RPA) allowed the researcher to have a one-on-one interaction with the respondents during the interview segment. The use of codes on a formulated table was necessary to check double interview and made the thematic content analysis easy and simple. Budgeting technique was used to calculate total cost, total revenue and profit base on data assembled from the interview.

2.6 Sampling procedure and size

The municipal has at least fifteen cocoa farming enclaves. Due to time and financial constraints, the researcher used simple random sampling to select five for the study.

All the communities shared common features in terms of age of cocoa farms, production capacities and climatic conditions such as precipitation and temperature distribution. Stangor (2011) averred that a suitable population should share certain basic common characteristics to guarantee a reasonable and doubtless generalization.

Each community has cocoa farmers' population of 100 at least on a commercial base. From each community a simple random sampling technique was used to select a sample size of 50 summing up to 250 farmers' respondents representing 50% of the population.

According to Engells, (2009) a sample size can be justified at 10% so long as the population from which the sample is drawn does not exceed 1000 cases.

CHAPTER 3: LITERATURE REVIEW

3 Cocoa and its production in general

As an international delicacy, chocolate is produced from cocoa beans grown on cacao trees. Research has shown that cocoa production and chocolate consumption existed in Central American prior to the visitation of Christopher Columbus to the Americas (Ayanful, 2016). World Cocoa Foundation, (2014) indicates that cocoa production in the Central Americas dates back to five millenniums. However, in the 21st century cocoa production and consumption is a complexity of global network involving almost all countries (FAO, 2015). It was estimated that by 2016, the global chocolate market worth $98.3 billion (Worldatlas, 2019)

Today almost all of the ten leading producers of cocoa countries share similar climatic conditions as the original home of the beans in the Americas. It must be pointed out that nations located within four continents comprise the top ten producing enclaves, and the largest producing countries out of the ten come from Africa where the beans have been imported by missionaries from Europe (Ayanful, 2016).

3.1 Major global exporters of Cocoa

Foresight Commodity Services incorporate presented the 2018/2019 major cocoa production countries (Foresight Commodity Services, 2020). The research discusses them in turn from the least to the highest, touching on what features distinguish each from the other on the global value chain.

Dominican Republic

The Dominican Republic is the ninth leading producers on global scale. When it comes to the production of chocolate, the Republic is take a global landmark lead in two thematic ways (Foresight commodity service, 2020). With respect of the indispensable role of the government it was noted by the Organization that the government endeavours to ensure that cocoa production is done in environment that supports sustainability of production. Moreover, in 2009 Dominican Republic was the pacesetter in fair-trade-certified cocoa production, a position it still enviably occupies on the global value chain of the beans. Fair-

trade products are those that have been vetted and certified under the supervisory role of the global trade organizations it ensures that cultivators of the crops are given the required compensation for the produce (Laura, 2016).

The Dominican Republic is known worldwide for two different types of cocoa; the Sanchez (4%) and Hispania (96%), the two crops accounted for production tons of 68,021 in 2013 (Foresight commodity service, 2020). Being the largest producer in the Caribbean, Dominican Republic produced 85, 599 tons in 2017/2018 and 75,000 in 2018/2019 seasons (Foresight Commodity Services, 2020) In 2015 according to FAO, (2015) the industry sustained 40,000 farmers, provided employment for over 350,000 people and contributed more than $21 million to the growth of the country.

Peru

The eighth largest producer of cocoa is Peru in Central America. The production of cocoa in the country faces fierce competition from the production of another cash crop called coca which is used to produce cocaine (Foresight commodity service, 2020). The production of coca share the same climatic and soil conditions with cocoa, however, due to the illegality of the crop it is more lucrative than cocoa, dwarfing the cocoa production, as farmers of cocoa are gradually been driven away from the business. Peru has recently been the World's largest producer of cocaine (Foresight commodity service, 2020). Much of the land for cocoa production have been turned into coca production, it is estimated that over 60,000 hectares of cultivable land have gone into coca production contributing to around 340 tons of global cocaine produced in 2018 alone (Keith, 2019).

The cacao farms and other crops share only 48,000 hectares of arable Peruvian land, with a total cocoa output of 105,000 tons in 2015. In 2017/2018 they increased their lot by producing 134,000 and 130, 000 in 2018/2019 season. The country managed to increase production from 130,000 in 2017/2018 to 134, 000 in 2018/2019 seasons (Foresight commodity service, 2020).

Ecuador

Being seventh on the list, the cocoa industry in Ecuador is among the oldest in the World (Bruna, 2020). In the region of the Amazon that enters Ecuador, archaeologists have discovered traces of cocoa in their pottery which dates back to five thousand years. The nation' total output weighing at 322,000 tons for 2018/2019 season honours the country's long standing history of cocoa production. In terms of total output production Ecuador is no match for the giant producers in West Africa, however, the quality of their chocolate is one of the finest in the World and it is preferred by majority of global consumers (Foresight commodity service, 2020).

While in fact many of the transnational companies prefer African's chocolates for the base of their processed treats, a handful of artisan consumers turn to Ecuador for complex taste cravings. In 2017/2018 Ecuador produced 287, 000 tons of the beans making them the seventh largest producers in the World earning them over $700 million (UNDP, 2019)

Brazil

Sixth on the list of the top ten producers of chocolate, Brazil's total output is very appreciable as their contribution to the global stock means much to the industries and consumers alike, in spite of the consistent fall in production over the last few years (Foresight commodity service, 2020). The fact that Brazil imports cocoa means that the country consume more than they sell- a trend that was noticed in 1998. The trend has been projected to remain for long period of time. Although, the country is the largest producer in the Americas with a constant average yearly production of 256,186 metric tons since 2013, the institute in charge of cocoa production in the country forecasts that Brazilian cocoa production will drop by another 15.7% between 2018 and 2024 (UNDP, 2019)

Brazil was toppled as the leading producer of cocoa globally, when the industry was hit by a deadly disease called ''fungus witches broom'' obliterating the plantations and eventually collapsing the industry utterly (Jen, 2018).

Brazil still the leader in production in the Americas suffered a plummeting in production from 40,000 ton in 1990 to 160,000 in 2003. Due to the application of modern technologies and the massive drastic measures undertaken by the Brazil National Association of the Cocoa Processing Industry (AIPC), the country succeeded in upping its production from woefully 160,000 in 2003 to 204,809 tons in 2017/2018 (Miguel & Batista, 2018) The AIPC is committed to doubling production by 2028. The production is predominant in the State of Bahia, the Amazon basin and the Espiritus Santo. Brazil's total contribution to the World overall production in the last four years amounted to 695, 000 tons (Foresight commodity service, 2020).

Cameroon

Away from the home to cocoa, the list now strides across the Atlantic Ocean to Africa, where four out of the five largest producers are homed (Foresight commodity service, 2020). In terms of total global output, West Africa leads in the production ahead of any other region. Being one of the prolific producers of the crop according to history, Cameroon produces over 275,000 metric tons since 2013 on a constant basis (Nfinn, 2015). As a fourth largest producer in the World, Cameroon produced 250,000 tons of beans in 20172018, 280,000 in 2018/2019 season. Just like in the remaining countries, the industry serves a strong backbone to the Cameroonian economy, guaranteeing jobs for over 60,000 people (Foresight commodity service, 2020).

Just like any of the producing countries in the world of cocoa production, Cameroonian cocoa industry is confronted with a daring threat. Incompetent management the crop presages a crassly dangerous situation, another problem stems from the age of the trees, the cocoa trees have outlived it productive age. Without a drastic revolution in the industry by way of cutting down diseased and aged trees and introducing newer and viable trees farmers are bound to face daunting and arduous task of production (CBI Market intelligence, 2018).

Not immune to problems, cocoa production in the country is threatened by abandonment by farmers due to sporadic conflicts within the regions were cocoa production is prominent. The crop is grown in 8 out of the 10 administrative regions of the country, nonetheless, on a large scale in the coastal zones betwixt the borders of Kribe and the

Nigerian border. Cocoa production in Cameroon uses approximately 450,000 hectares of the landscape.(Nfinn, 2019)

Nigeria

Nigeria is the fourth highest producer of cocoa in the World. Massive application of technology to cocoa production significantly augmented the country's fortunes in the industry (Foresight commodity service, 2020). In the 2012/2013 seasons cocoa production in Nigeria hover around 367,000 tons, in its states of the nation's address the government promised to increased production to 421.300 tons in the 2013/2014 season. By the close of the 2015/2016 the country has improved production from around 192,000 tons IN 2014/2015 to over 200,000 tons (Foresight commodity service, 2020).

Taking up 80,000 hectares of the country's landscape cocoa production employs over 300,000 people. In 2017 the country produced over 328,265 tons contributing to 2% of the country's total export. 60% of the country total output come from the following states were they climate is supportive of the plantations; Ondo, Oyo, Ogun,and Ekiti (Farady, 2017)

Being one time the second largest producer in the World, the discovery of oil in commercial quantities in the 1970 diverted governments' attention to the oil sector, thereby stripping the country of its second slot. Ageing cocoa trees, diseased trees resulting in low yields and dearth of knowledge in the nitty-gritty of the cocoa farming activities on the side of the smallholder farmers have bedevilled the industry. The country has contributed around 945, 000 tons to global output in the last four years (Foresight commodity service, 2020).

The cocoa association of Nigeria (CAN) have attempted to revamp the ailing industry after long years of abandonment and near collapse by the state. Availability of land, the existence of the favourable climatic conditions and willing farmers are factors that promise of a possible revival of the industry (Farady, 2017)

Just like any of the cocoa growing countries Nigeria was faced with formidable troubles besetting the industry, diseases and old trees impedes production. Women were identified as the major working force in the industry, yet they are discriminated against in terms of paid for services rendered on the farm according to research conducted by Oxfam.

Indonesia.

Up until the 1980s Indonesia was alien to cocoa production. The country grew no cocoa until the latter part of 1990 (Foresight commodity service, 2020). Being the third largest producers of cocoa Indonesia production improved astronomically when production set off growing 777,500 tons in 2013 growing season according to FAO report on 2016/2017 season the country produced 270,000 tons that make the crop the fourth largest agricultural export for the country. In the last four years Indonesia's contribution to the global output accounts for 1030 tons (FAO, 2018).

Common to the growth of the industry is pestilences infesting the crops with a variety of diseases. Indonesia cocoa crops are commonly susceptible to the pod borer insects, which has thwarted the industry's growth painfully (FAO, 2018)

Until the 2000's Indonesians cocoa production industry has been on constant uptick after the decline of the attack by the pod borer insects, but recent production output suggest a significant slump in production afterwards. Indonesian, Ghanaian and Ivorian cocoa production is a reserve of the smallholder farmers who only use simple tools to cultivate, which international experts claim is the best method to be adopted than that of corporate farmers. Roughly, 1.5 million hectares of the country's landscape is dedicated to the cultivation of cocoa; the Island of Sulawesi produces 75% of the total national output. Other areas were the industry thrives commonly include North Sumatra, West Java, Papua, and East Kalimantan. As witnessed in all the countries discussed the industry in Indonesia is handled by smallholder farmers (Foresight commodity service, 2020).

Factors militating against the success of the industry include aged trees, lack of domestic patronage, and competition from other cash crops which is attracting cocoa farmers.

Ghana

In Ghana, cocoa is affectionate called the king of cash crops, with its production accounting for just under a sixth of the country's GDP (Foresight commodity service, 2020). Cocoa production is basically is in the hands of smallholder farmers, cocoa is grown in the forest regions of the country, with almost 60% of the arable land dedicated to cocoa production. Cocoa is owned and tendered by family of farmers who live on the property. Over 800,000 people employed in the industry, with 1.9 million hectares of the country's landscape dedicated to the industry, the crop is the main cash crop for the country (Preprah, 2019).

Being the second largest producer in the World, Ghana produced 905 tons is 2017/2018, accounting for $2 billion in foreign exchange annually. Their major trading partners are the European Union, the United States, and China. Their share of total World production in the last four years was 3,464 tons (Foresight commodity service, 2020).

Despite the dearth of corporate control or the inadequacy of it, production cost is major canker bedevilling the industry, farmers find it extremely difficult to honour the productions cost. One major historic problem of the industry is that farmers are short-changed, contrarily to their counterparts in Ivory Coast where the prices of cocoa cost much higher than Ghana, this discrepancies in payment, deemed unacceptable by the Ghanaian farmer instigates them to smuggle the beans to Ivorian Coast where better prices are offered them (Nkamleu & Kielland, 2015). The Ghana Cocoa Board is responsible for the management of the industry; they are responsible for providing extension services, price fixing for farmers and control of quality and assurance of quality, in other to meet international standards.

The industry in Ghana is undergoing serious threat from illegal mining activities, the country lost over a quarter of its cultivable land and forest cover between 1990 and 2005 and another 500,000 hectares between 2001 and 2003. With the cause of the problem operating unabated the country is likely to lose its slot to Indonesia (Foresight commodity service, 2020).

Ivory Coast

Ivory is the leading producers of cocoa in the World. The country supplies an average of 30% of the World's total output since the last decade leading the World with more than half a million metric tons with a total annual production of 1.448,992 tons as of 2013 (Foresight commodity service, 2020). In 2017 it solely contributed 1,964 tons to the global production representing 30%. The important of the industry to the economic standing of the country is based on the fact that it contributes 40.2% of the country's total income. Moreover, it provides employment for approximately 600,000 farmers and survives almost 6 million people (Chatterjee, 2011)

Due to the quality of its cocoa beans multinational companies like Cadbury and Nestle rely mostly on their production to feed their industries. It is estimated that cocoa alone contributes about two thirds of the external trade revenue to the country. The cocoa industry in Ivory Coast have faced serious public lambaste on their notoriety for the use of child labour with children from neighbouring countries such as Benin, Nigerian and Togo. Child labourers, some of whom cajoled due to their predicament to work for more than 80 hours a work alongside being manhandled by their employers (Foresight commodity service, 2020).

Many of the farms responsible for the country's humungous output are found culpable of child labour and child abuse. In addition to the inhumane treatment they are being subjected to the children have no opportunity to receive formal education. The phenomenon of cocoa smuggling from Ghana accounts for the massive production in the country, it must be noted that no all beans exported in Ivorian Coast actually grew on their soil (CBI Market intelligence, 2018).

Deforestation, unpredictability of the weather financial constraints and child labour and irresponsible farming are the major factors threatening the industry.

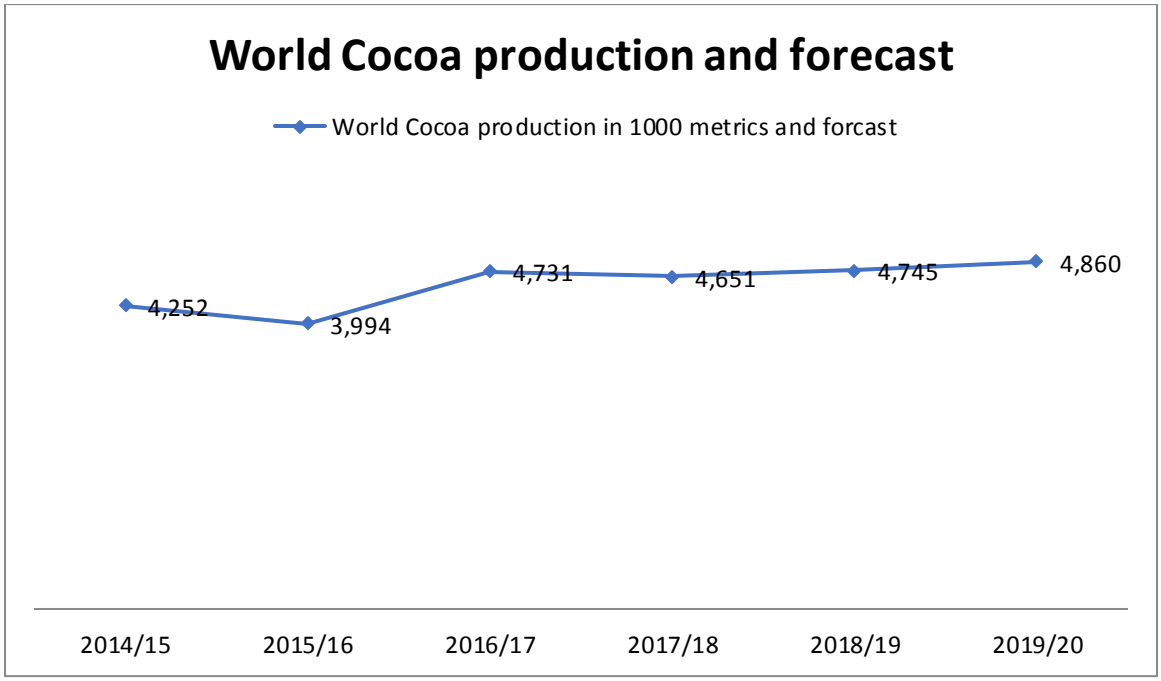
3.2 Trend and forecast of cocoa production in the World

Table 1: World Cocoa Production and forecast 2014/2015-2019/2020

Country	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	% change 2018/19
			1,000 metric tons				
Ivory Coast	1,796	1,581	2,020	1,964	2,154	2,200	+2
Ghana	740	778	969	905	812	855	+5
Indonesia	325	320	270	240	200	200	0
Cameroun	232	211	246	250	280	290	+4
Ecuador	261	232	290	287	322	330	+2
Brazil	230	141	174	204	176	190	+8
Nigeria	195	200	245	250	250	255	+2
Peru	92	105	116	134	130	135	+4
Dominican Republic	82	80	57	85	75	75	0
Others	299	346	344	332	345	330	+2
World Total	4,252	3,994	4,731	4,651	4,745	4,860	+2

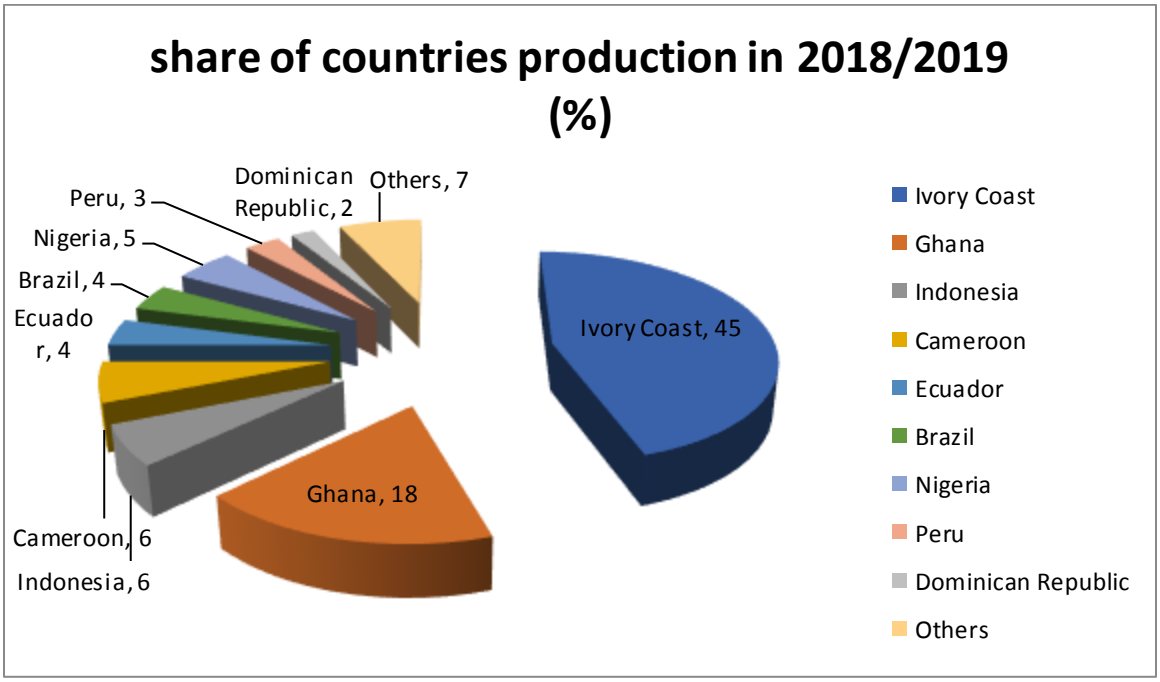
Source: Foresight Commodity Services: (2020)

Figure 2: Trend of World Cocoa Production in tons from 2014/2015-2019/2020



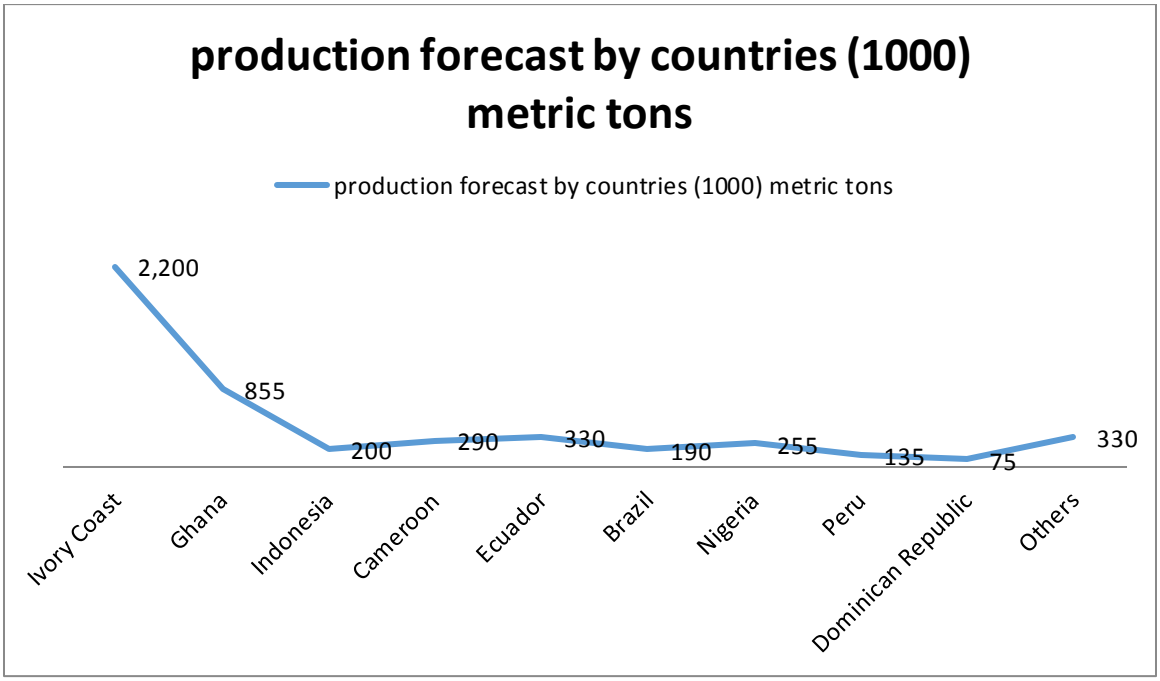
Source: Foresight Commodity Services (2020)

Figure 3: Share of countries production in 2018/2019 (%)



Source: Foresight Commodity Services (2020)

Figure 4: Global production forecast for 2019/2020 (metric tons)



Source: Foresight Commodity Services (2020)

Figure 2 and 3 global cocoa productions presents a positive trend for all categories about from Indonesia and the Dominican Republic, however, per the years in retrospect the increase is of less significance. The total production for the estimated 2019/2020 seasons rises by only 2%. Although, Brazil and Ghana projects encouraging figures, the other figures do not promise of a successful productive future.

3.3 Variety of Cocoa beans

Three major varieties of cocoa plant popular among the major commercial production regions are the Forastero, Criolio, and Trinitario. Forastero is the most commonly cultivated, comprising 80% - 90% of the total world production of cocoa. The Criolio variety are the less cultivated in the industry as it is scarcely considered a delicacy (Spadaccini, 2015). The Criolio variety has lower yields when compared with the Forastero variety, it also tend to be vulnerable to a number of diseases of cocoa plant. Hence the few number of countries interested in its production (Barry, 2013).

In chuao and Porcelana in mainland Venezuela, the cultivation of the Criolio variety is largely produced. The Trinitario original to Trinidad is a hybrid of the Criolio and Forastero varieties. Trinitario is widely considered to be of higher quality than the Farastero, it also have higher yields, and acclaimed to be resistant to diseases than the other two (Barry, 2013).

3.4 Cocoa production and trade in the World

The global cocoa market offers good opportunities for developing countries. Europe is a dominant force in the cocoa sector, representing more than half of global cocoa bean imports. Furthermore, most beans are imported directly from developing countries, the Netherlands, Belgium and Germany being the largest importers. However, competition in the mass-consumption market is fierce. Producers are therefore recommended to focus on premium/specially/fine flavour cocoa, also because European demand for such products is increasing (CBI Market intelligence, 2018).

The global cocoa market offers fantastic opportunities for developing countries that produce cocoa on commercial quantities. The dominant forces in the global cocoa sector are North America and Europe, representing about 85% of the global beans imports (CBI Market intelligence, 2018). In Europe for instance more beans are imported directly from producing developing countries, the Netherlands, Germany, France and Belgium are the largest importers in Europe (CBI, 2018). United States, Canada, Malaysia and Australia are the major global contenders to Europe. Global competition in the market is keen.

The global demand for cocoa products varies from country to country, in view of the differences in products demand for the crop; the Harmonised System (HS) codes have been invented to allow for better and clarity in specifications.

The harmonized system codes are applied for the classification of cocoa products and to enable accurate calculations of statistics for the international trade, including imports and exports. For the purpose of this document the statistical analysis would be based on the following codes in the table below. The focal point will be on HS 1801 and HS 1806 because they represent the greatest tons of products for developing countries within the context of global demand. Developing cocoa producing countries prefer to export the cocoa beans in its

raw state to adding values to them, though a handful of them endeavour to turn it into final finished products before exporting onto the global market (Ha-Jong, 2012)

Table 2: Harmonized System for classification of cocoa products

HS codes	Official product description
1801	Cocoa beans, whole or broken, raw of roasted
1802	Cocoa paste, whether or not defatted
1803	Cocoa butter, fat and oil
1804	Cocoa powder, not containing added sugar or sweetening matter
1806	Chocolate and other food, preparations containing cocoa

Source: CBI (2018)

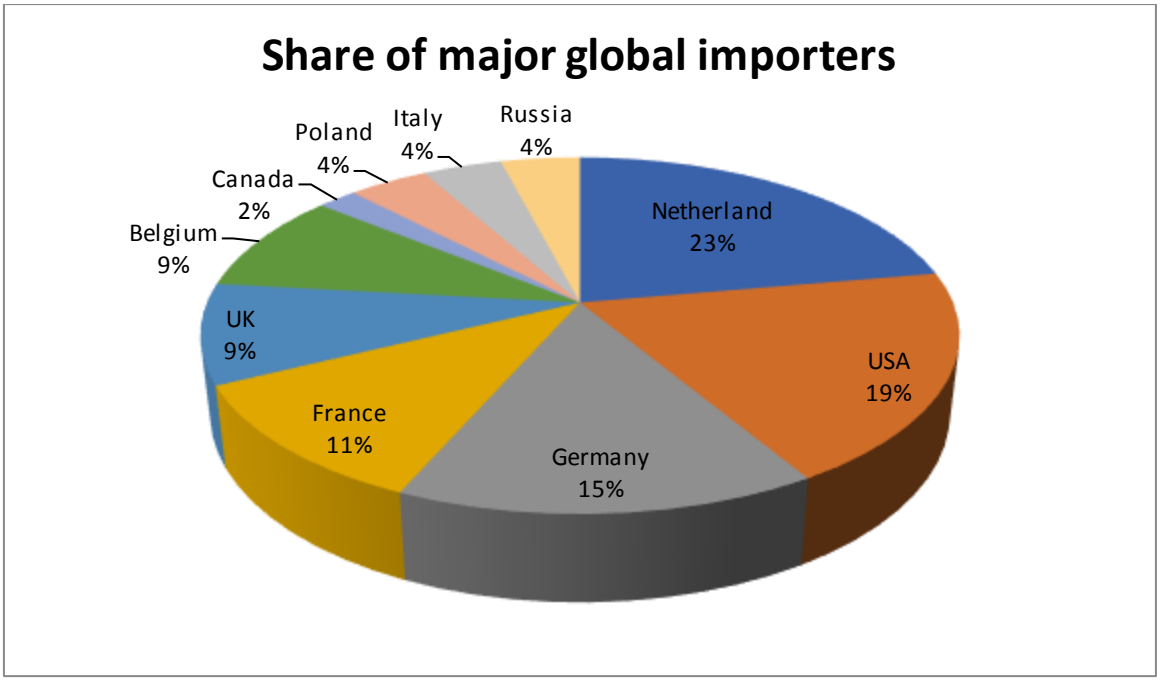
How much cocoa is imported globally? The demand for cocoa beans is common in many countries across the global due to the versatility of the beans for the production of a number of meals. The harmonized system provides a snapshot of the various forms of cocoa products that are imported, mostly by advanced economies. Table 2 presents records of the highest importer of cocoa products specified under the category HS 1801

Table 3: Major exporters of Cocoa beans (million metric tons) classified under HS 1801

Countries	Metric tons	Percentage	Value in dollars
Netherland	16,87,433.00	22.1	4,857,00
USA	13,39,026.00	19	4,857,00
Germany	11,04,942.00	15	4,636,00
France	8,32,102.00	11	3,465,00
UK	6,65,924.00	9	2,778,00
Belgium	6,74,618.00	9	2,460,00
Canada	1,02,631.00	2	1,553,00
Poland	3,22,648.00	4	1,325,00
Italy	3,24,039.00	4	1,261,00
Russia	3,16,626.00	4	1,180,00
Total	73,69,989.00	100	28,372

Source: Comtrade, United Nations (2018)

Figure 5: Share of major global importers of HS 1801 (%)



Source: Comtrade, United Nations (2018)

Figure 4 indicates global share of cocoa importation base on the category HS 1801. The Netherland is the World leader in the importation of cocoa beans in its raw state, followed by the United States with a percentage of 19%, closely following USA is Germany with 15%. As it was indicated previous, the European Union and North America are the leaders in the global competition for category HS 1801.

Overall imports of cocoa and its derivatives by the World are significantly important in the global agriculture products. For instance the European Union alone had accumulated value of £19.3 billion in 2014. It was estimated that 27% of the amount was directly imported from developing countries particularly, in the production hubs of West Africa, contributing a value of £5.2 billion

Cocoa beans are the major products group popularly imported from developing countries, it accounts for 64%, followed by cocoa butter, fat and oil 19% and 14% for cocoa paste (ITC, 2018)

3.5 Chocolate imports by countries

Here the researcher discusses another important derivative of cocoa imported by the major countries. As stipulated in the harmonized system, the code 1805 represents imports derivatives including chocolate and other food, preparation containing cocoa. Since the system indiscriminatingly lumps several products together with the most popular of in terms of trade, the researcher singled out chocolate for the discussion.

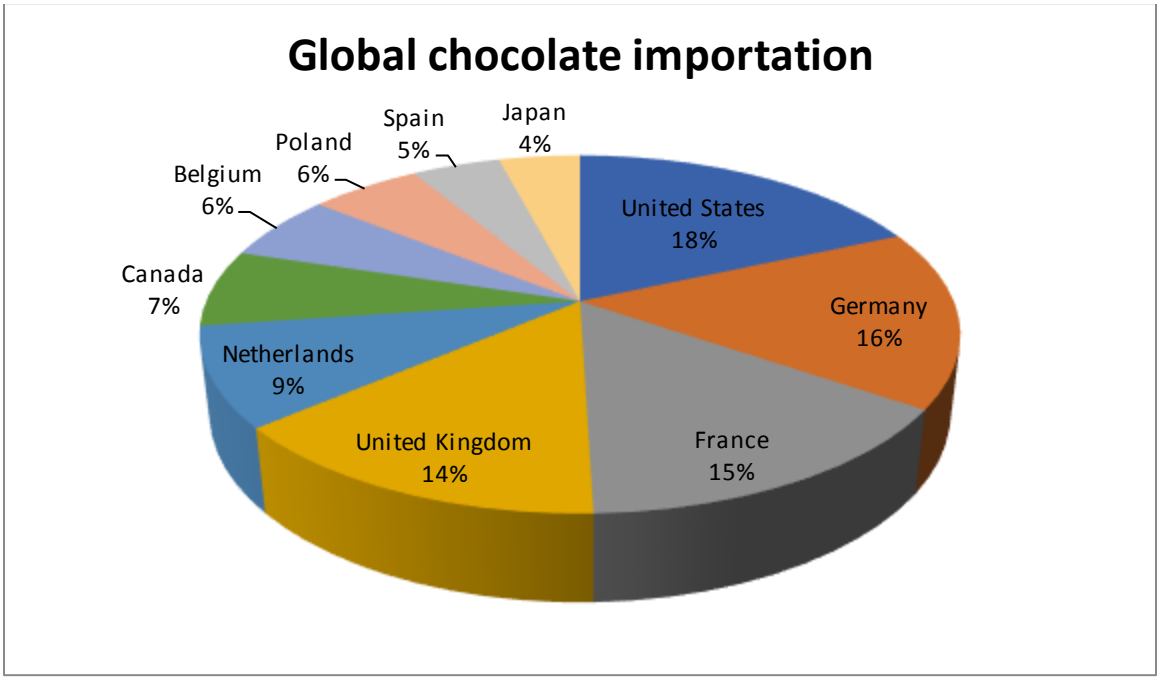
Almost every country in the World consumes chocolate in several forms; there are however, major countries notable for the importation of chocolate boosting of the highest record of consumption (Workman, 2019) It also looks at the value in terms of dollars. Table 4 presents the top ten importers of chocolate in the World with the highest value dollar value and percentages per each country in 2018.

Table 4: Top ten importers of chocolates (HS1806) with highest value in million and billion (USD $)

Rank	Importing country	Imports in (USD$)	World total (%)
1	United States	2.7 billion	9.8
2	Germany	2.4 billion	8.6
3	France	2.2 billion	8
4	United Kingdom	2.1 billion	7.6
5	Netherland	1.3 billion	4.8
6	Canada	1 billion	3.7
7	Belgium	889.7 million	3.2
8	Poland	842.1 million	3
9	Spain	663.4 million	2.4
10	Japan	607.8 million	2.2

Source: (Worldfact Book, 2019)

Figure 6: World Total imports of HS 18016 by countries in percentages (%)



Source: Trade Map (2019)

In terms of values the, the top ten countries together purchased 62.5% of total chocolate imports globally in 2018 (Trade Map, 2019). Percentages of total global shipment of chocolate for each country are indicated by the character in the parenthesis. Although the United States, Germany and France are the leading largest importer by the Figure 6, records reveals that Poland by 30% increment is the leading importer of chocolate since 2014 follow by Netherlands with 21.1%, United States by 18.5% and Belgium making up to the list with 10.4% increment (Workman, 2019)

Russia and Germany showed a downtrend in importation by 14.4% and 7.4% respectively since 2014 (WorldTop Exports, 2019). According to Worldtop Exporters (2019), global consumption of imported chocolate hit a global record of US$28 billion in 2018. In total, the overall value of chocolates imports increased by 1% for all countries since 2014 at the time that international patronage of the product cost $27.7 billion (Workman, 2019).

Between 2017 and 2019 the importation of chocolate rose by 2.6% according to (Investopedia, 2019). Based on international assessment Europe invested most on importation

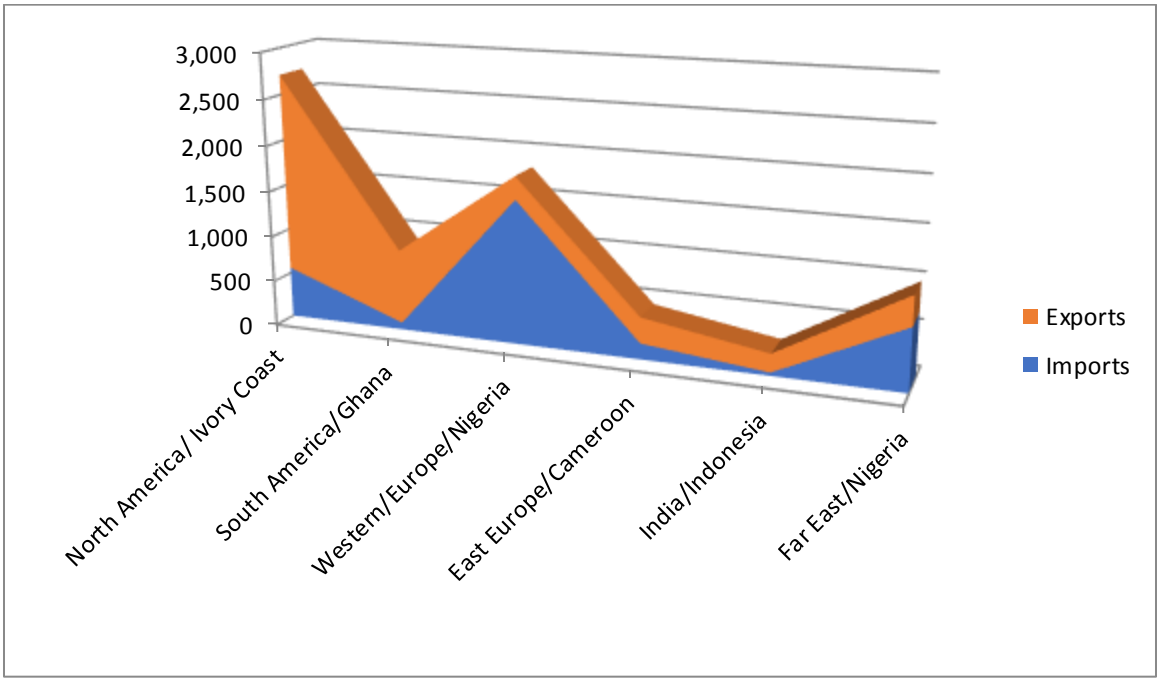
of chocolate in 2018 as depicted in the figure 6 with $14.8billion representing 57% follow by North America with $3.7billion representing 25%, United Kingdom with $2.1billion 14% and Asia represented by Japan with 4% .conclusively, Europe has the highest number of importers and consumption of chocolate under the harmonized system of HS 1806.

Although production of cocoa crop is dominant in few countries within the tropical zones of the World, exportation of the cocoa beans and cocoa products is vastly distributed across almost all the industrialized economies in the World (Edward, 2018). Annual cocoa bean output in the World drastically increased from 2.9 million tons in 1995 to 4.4 million tons as of 2016, while by the same trajectory the annual cocoa export significantly increased from 1.8 million metric tons to 2.7 million metric tons within the same year range (Bangmarigu & Qineti, 2018)

Amoro & Shen, (2017) have argued for a positive relationship between production and export records at the global level. Rosdi, (1991) delved into the main factors that determine the prices of cocoa, his methodology comprises of supply, demand and prices calculus, with stock as the identity. Rosdi found out that domestic prices are determined by prices on the world market. According to his model domestic stock change is not significantly important.

Some experts in cocoa production and export have endeavoured to inquire into the variables that influence production and export of cocoa. For instance Boansi, (2016) assessed cocoa production in the producing areas and consequently postulated that there exists a strong positive connection between current cocoa exports and production. The role of domestic farmers in the rate of global cocoa exports cannot be underrated (Bruin & Meeman, 2015)

Figure 7: global cocoa trade flows for the 2018/2019 seasons



Source: Sucden Research (2019)

Cocoa beans are produced in countries basically along the equator. Half of the World's cocoa bean production undergoes processing in the same countries of harvest, while the other half is exported and processed outside its growing domain. The major producing countries are located in Africa, with Ivory Coast and Ghana leading production respectively. However, production levels in areas such as Ecuador and, Brazil and the Indonesia are appreciating. Cocoa export destinations are countries around the World, nonetheless, just as production the major exporting and processing regions is the EU (Sucden, 2019).

3.6 Key factors that may influence demand and supply

The outbreak of Coronavirus on a global scale might undermine the forecast drastically. In view of the devastating effect the outbreak portends for the forecast, these numbers are assumed by the principle of Ceteris Paribus by considering only issues unrelated to Coronavirus. The international Cocoa Organization has pointed out 85,000 tons deficit of cocoa production in 2019/2020 season (Meyers & Gillett, 2020).

According to the report by foresight, exporters have indicated that cocoa arrivals in the Ivory Coast were gauged at around 1,567,000 tons March 8, up to 1% from the same period last production year. Moreover, unfriendly weather conditions in West Africa presage a possible decline in yield in Ghana the second major producing country for a second record on a roll.

It was reported again that local farmers in Ivory Coast entertain fear of bankruptcy due to competition from rich multinational companies offering higher prices for cocoa beans (Defoer, 2017). In Nigeria and Cameroon the seasonal Harmattan occurred in two major cocoa producing areas.

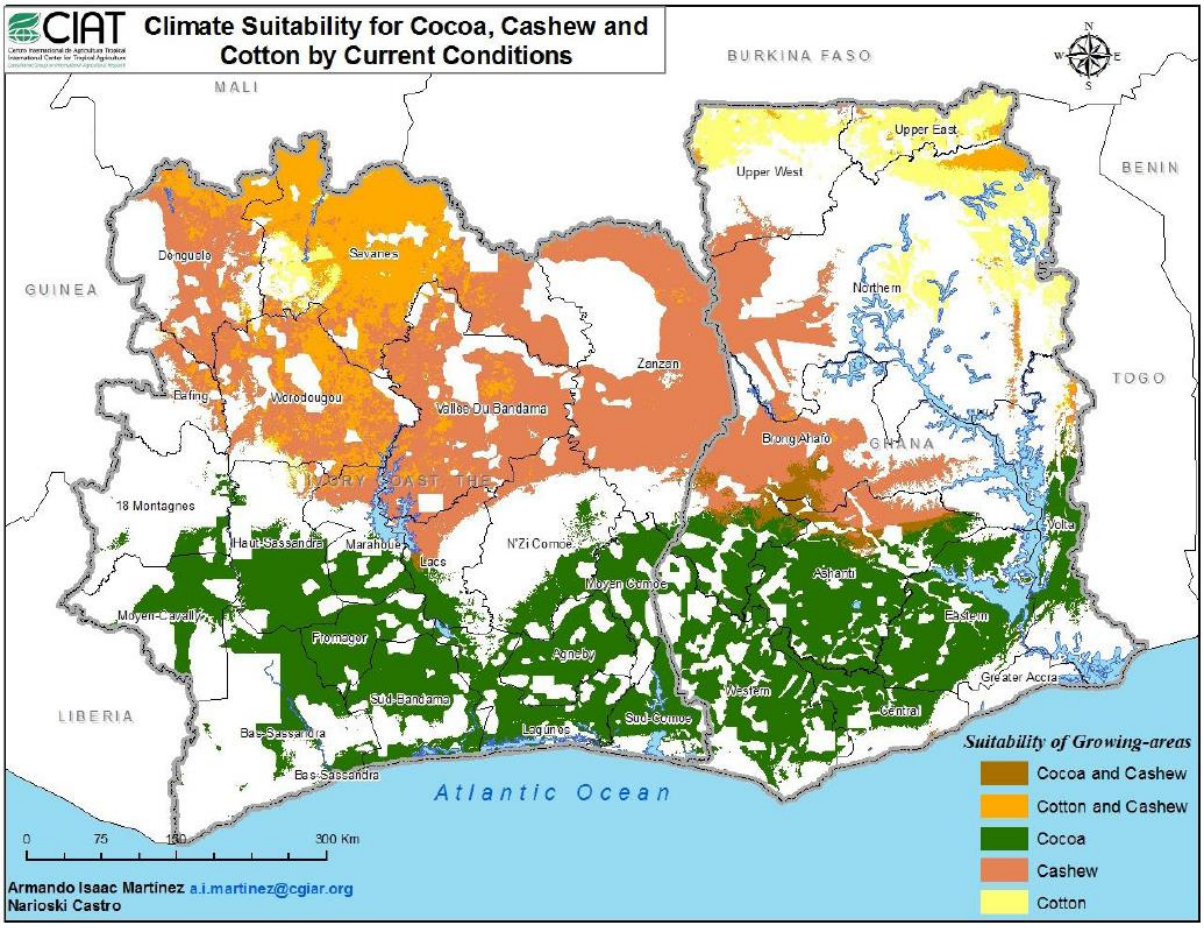
3.7 Analysis of cocoa production in Ghana- a wider overview

The cocoa sector in Ghana has not been spectacular, emerging as the world's leading producers of cocoa since the colonial era, Ghana experienced a major decline in production in the 1960s and 19070s, and the sector nearly fell into a decade of comatose in the early 1980s, production steadily recovered in the mid-1980s after the introduction of economy wide reforms, and the 1990s marked the beginning of revival, with production nearly doubling between 2001 and 2013 Kovalli, (2011), the story is still not soothing for an economy whose backbone has been cocoa production.

In spite of the numerous problems confronting the cocoa industry the country remains the second largest producer in the World, producing the most quality of the cocoa beans for global consumption (Cardno, 2017).

In the following graph the major producing regions have been discussed to give a holistic picture of the rate of production by regions.

Figure 8: Map showing cocoa producing regions in Ghana



Source: Takvera.blogspot.com

Ghana is divided again into three vegetation areas, the savannah, the forest and the coastal zones; this classification was naturally determined by the climate necessities. Each zone is suitable for the cultivation of certain crops according to the suitability of the climate and soil conditions, Cocoa cultivation is mostly practiced in the forest zones of the southern part where the climate and the soil is supportive, production is massive in the country's forested areas like Ashanti Region, Brong Ahafo Region, Central Region, Eastern Region, Western Region and the Volta Region, where rainfall is 1.000-1.500 mililimetres

3.8 The role of institutions in cocoa production in Ghana

Ghana is the only cocoa producing country which has a controlled marketing system. External market is controlled by the Cocoa Market board; all Cocoa beans are sold to Licensed Buying Companies (LBC), which in turn sell to the Cocobod (Government

Principal body) or to domestic industries for local processing (Abekoe, Obeng-Ofori, & Egyir, 2002)

The Ghana Cocoa Marketing Board (CMB) was disbanded in 1979 and was reconstituted as the Ghana Cocoa Board (Bruin & Meerman, 2014). To all intent and purposes the Cocobod was establish to develop and promote the growth of the industry and to make it globally competitive by abiding by rules and regulations as well as standards of international trade. The board was also to ensure quality control and assurance for products offered for the world market (Padi, Ackonor, Abitey, Owusu, Fofie, & Asante, 2016)

The board which was created in 1979 commenced its policy of internationalization in the early parts of 1990, the board's first major forward looking policy was liberalization and privatization of its services, it initially raised prices to producers in a way to incentivize and sustain the industry, it also introduced a brand new system that provided tremendous incentives for private traders. In an attempt to maintain the standard, quality control and assurance the board jealously handled overseas shipment and export (Padi et al, 2016)

Among some of the internalization and globalization policies, aside the market reforms, successive governments redesigned cocoa production, for instance government supplied farmers with seedlings to replace trees that withered out in the 1983 drought and over-age trees, and an estimated 40 hectares continued to be added to the total area of 800,000 hectares under the year of production (Appiah, 2014)

Infrastructure development reforms saw the upgrade of existing and construction of 3.000 kilometres of new feeder roads to ensure ease movement of cocoa from rural communities. Furthermore, the government made an effort to increase the country's supply from 300 kilograms per hectare to make it competitive with their major regional contenders on the international market (Ramjeawon & Von, 2015)

New emphasis was laid on extension services, drought, land tenure, disease research and application of science (fertilizer and insecticides). The objective of these commitments by government was to be realized in the improvement in cocoa production industry and be able to withstand the pressure and competition on the international market front (Dreyer, Hauschild, & Schierbeck, 2016)

A number of institutions were established to ring about their freshness f perspective to the industry for the sustainable and inclusive development and growth of the sector and most especially focusing on the farmer, these bodies with special and non-conflicting mandate include the following; the Cocoa Research Institute of Ghana (CRIG), Seed Production and Extension Division (SPD), Cocoa Health and Extension Division (CHED), Quality Control Company (QCC) and the Cocoa Marketing Company (CMC) (Ghana Cocoa Farmers Newspaper, 2015)

These reforms and measure brought the following decades of declining output and stagnation to an end upping production levels. The governments of Ghana made huge investments in infrastructure in the industry through the aforementioned bodies, improving productivity, and reducing market inefficiencies (Omorogbe, Jelena, & Fatima, 2014)

It has ambitious courageous goals to raise output while at the same time perpetuating its-envious industry-leading quality credentials. The institutionalization of these bodies under the larger mandate of the Cocoa Board has been prosperous in subsequent years, evidenced in national output in the most current years together with rising export gains. In 2009-10, Ghana exported more than 500.000 tons of beans, raising more than US $1.6 billion (World Bank, 2011)

The introduction of a special package offer called the Cocoa Abrabopa by a private company, Wienco through Public Private Partnership under the auspice of the Cocobod was a blessing to the cocoa industry, in its first year of application, and the package raised yields from 510 to 1.081 kilograms per hectare to 2.317 per hectare after the third year (Vigneri, 2011)

The brainchild of Wienco the Cocoa Abrobopa Association was created and institutionalised in 2006, the package offered credit and technical and business training to farmers. The number of cocoa producer that partook in the program reached 11.000 in 2008. An assessment of the program in 2008 showed that the principle of collective liability applied in the package encourage at least to the effectiveness of the chemical and other inputs supplied by the establishment (Omorogbe, Jelena, & Fatima, 2014).

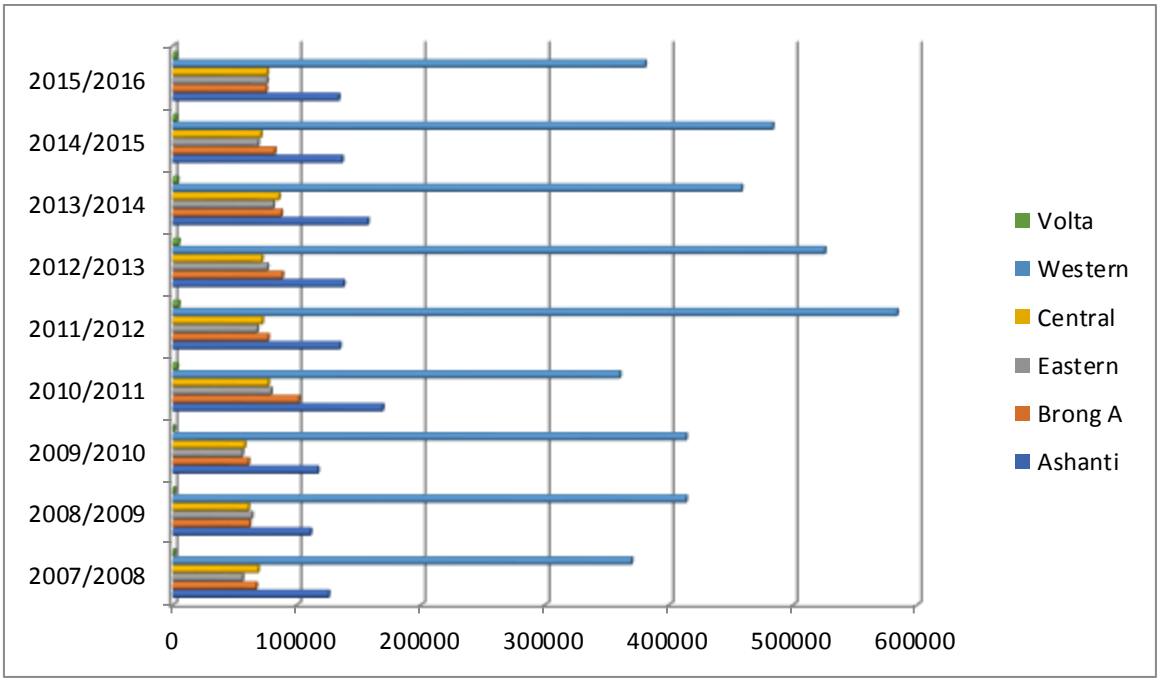
Table 5: National cocoa purchase by regions in Ghana in 1,000 metric tons from 2007/08-2015/16

CROP YEAR	Ashanti	*Brong* Ahafo	Eastern Region	Central Region	Western Region	Volta Region	Total (1,000)
2007/2008	125270	66921	55916	68378	369458	838	680781
2008/2009	110643	61562	63409	60686	413395	951	710642
2009/2010	116538	60600	55736	57562	413395	595	650641
2010/2011	168916	101302	78928	76563	359910	3241	1012839
2011/2012	134295	76511	67713	71760	583589	4495	879349
2012/2013	137379	88034	75912	71540	525237	4495	835467
2013/2014	156902	87116	80692	85446	458107	3481	896916
2014/2015	136134	81896	68415	70690	483279	2650	740254
2015/2016	133462	74943	75787	75870	380469	2680	778044

Source: Cocobod (2017)

The adoption of technology to cocoa farming in Ghana has major sustainable development importance in all the six major growing regions. In the Western region for instance private company called Rainforest Alliance trained famers on how to apply sustainable practices in their occupation, and the results have proven that production levels and yield have risen astronomically in part of the region where the farmers had the opportunity to undergo the training (Rianforest Alliance, 2018).

Figure 9: National cocoa purchase by regions in Ghana in metric tons (1000) from 2007/08-2015/16

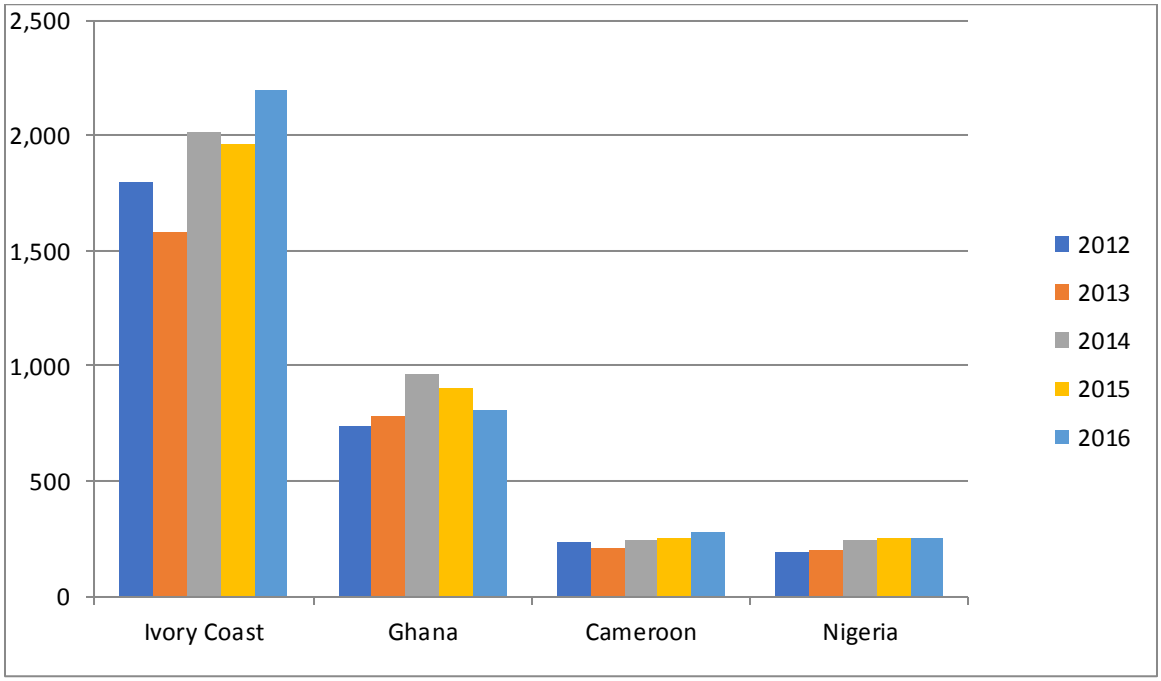


Source: Cocobod.stats (2017)

Cocoa cultivation in Ghana is spread in six regions; eastern, Ashanti, Brong Ahafo, Central, Volta and Western region. Due to persistent fluctuation in rainfall and decreasing in soil fertility, production has moved to concentrate in the Western region making the region the prolific producer of cocoa in the country. Western region has dominated production in all the years under consideration; following closely is the Ashanti region. The Eastern region is the third major producing region, with central and Brong Ahafo making the list.

Contributions made by the regions have immensely contributed to the country's position on the global production list. Among the four major producers in West Africa Ghana places second to the Ivory Coast, production vastly ahead of Nigeria, and Cameroun. The effort is attributable to the intervention role of the government and other existing companies. The licensed buying companies assist the farmers by giving them incentives.

Figure 10: Countries share of regional production in metric tons (2012-2016)



Source: FAOSTAT (2017)

The production gap between Ghana and the Ivory Coast is a worrying situation that governments have over the years endeavoured to bridge through farmer friendly reforms such as mass spraying subsidize fertilizers, chemicals and other inputs.

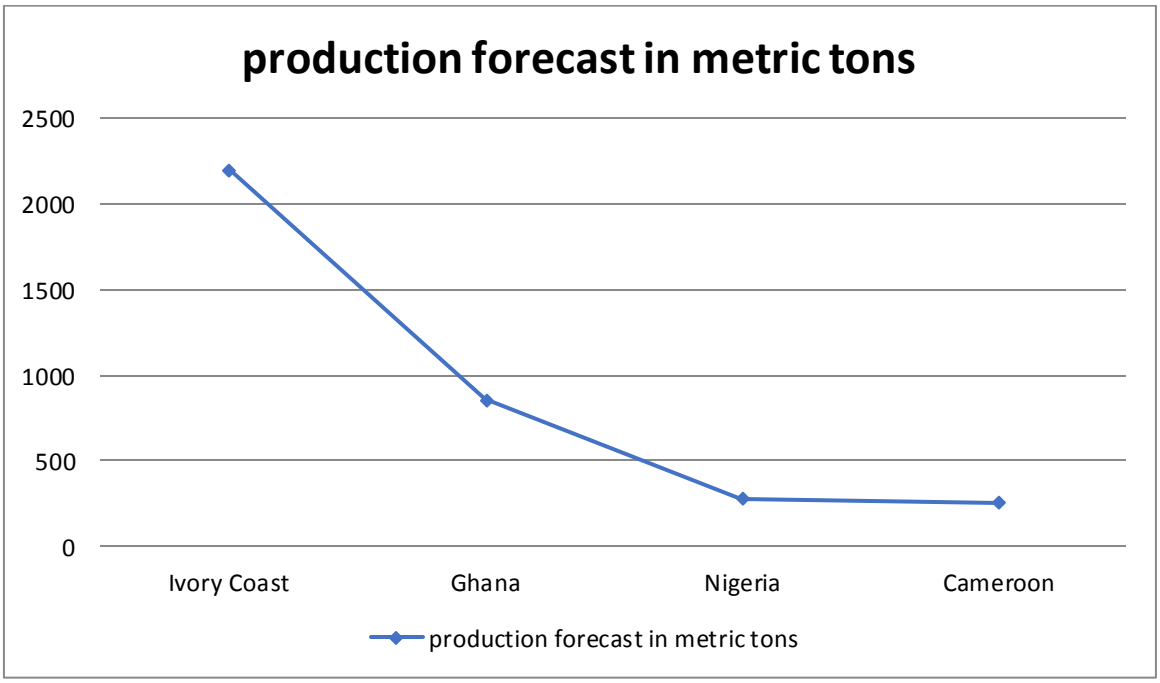
Forecast of production in the region shows that production in Ghana will be higher than the four regional contenders. While the country lags behind the Ivory Coast in the impending year, in terms of production per 2019/2020 season Ghana seems to outpace Ivory Coast.

Table 6: Regional Production forecast for 2019/2020 season in 1,000 metric tons

Countries	2018/19	2019/20
Ivory Coast	2,154	2,200
Ghana	812	855
Nigeria	250	255
Cameroon	280	290

Source: CBI (2020)

Figure 11: Regional Production forecast for 2019/2020 season in metric tons (1000)



Source: Author computation from CBI figures

3.9 Challenges facing the cocoa industry

The cocoa industry just like any other industry is threatened by problems potent enough to undermine its' capacity and energy for survival, challenges are identified at any level of the value chain.

Among the problems facing the sector are unpredictable weather and climatic conditions, decline in productivity, no or less innovation by managers, technology and knowledge transfer, declined in soil fertility and fecundity, pestilence and disease, ageing trees and competition from other cash crops (CBI Market intelligence, 2018). Low and unstable cocoa prices coupled with whimsical pricing system controlled by multinational companies have created poverty among the farmers.

Under this chapter the researcher considers and discusses one of the major problems confronting the cocoa industry.

3.9.1 Pest and diseases

The cocoa industry just like any other industry is threatened by problems potent enough to undermine its' capacity and energy for survival, challenges are identified at any level of the value chain.

Among the problems facing the sector are unpredictable weather and climatic conditions, decline in productivity, no or less innovation by managers, technology and knowledge transfer, declined in soil fertility and fecundity, pestilence and disease, ageing trees and competition from other cash crops (CBI, 2018). Low and unstable cocoa prices coupled with whimsical pricing system controlled by multinational companies have created poverty among the farmers. Under this chapter the researcher considers and discusses pestilence and diseases that traditionally affect the cocoa industry. Pestilence and diseases are a sort of common nightmares to small holders' farmers who are the major stakeholders in cocoa production.

As an exotic crop, the cocoa crop has contracted countless number of formidable new diseases now and then, emanating from the indigenous flora but which exotics have still not been able to find an effective defence mechanism to (Barbara, Janny, & Flood, 2018). Ruff,

(2017), indicated in his study of cocoa production in Ghana that, in the Amazon where the crop originated, particularly, in the upper reaches of the rain forest, cocoa crops undergo natural reversal of disease infection and the plants gain their health back without the effort of the farmer. In Central America and South America, however, the case is utterly opposite, serious diseases such as Witches Broom and Frosty Pod continue to disturb the health of the cocoa trees while the farmers are helpless (Barbara et al, 2018)

3.9.2 Climatic conditions

On the other hand, in regions where the crop was introduced, the crop is becoming increasingly vulnerable to an array of diseases which are as a matter of history domestic to those areas (Ruf, 2017). (Smucker, Gardy, Mike, & Ben, 2005) Cited in their study in West Africa, that poor farmers have to contend with a wide range of assorted unfamiliar pest organisms of which the major ones are Black Pod, Mirids, Stem Borer, Mistletoe, Termites, Weeds and Cocoa Swollen Shoot Virus.

Most diseases common to cocoa have been identified to be fungal. Black pod caused by *phytolphtora* a member of the fungus family is a major contributor to largest loss of cocoa pods (Greco et al, 2007). Aside the back pod disease is number of equally dangerous diseases that affect cocoa pods and plants; vascular streak dieback, Witches Broom and Frosty pod rot diseases.

The following table presents the commonest pests and diseases common with cocoa production from around the World. The list incorporates domestic, regional and interregional diseases and pest mostly encountered by cocoa farmers globally. Those with scientific names are provides against them.

Table 7: Major pests and diseases of cocoa

DISEASES AND PESTS	VIROLOGY AND MICROBIAL NAMES
Black pod	Phytophthora species
Cocoa pod borer	Conopomorpha cramerella
Cocoa Swollen Shoot Virus	CSSV
Frosty pod rot	Crinipellis roreri
Mirids (Capsids)	Sap sucking bugs
Mistletoes	Plant parasites of cocoa
Stem borer	
Termites or white ants	
Vascular streak dieback	Oncobasidium theobromae
Witches Broom	Crinipellis perniciosa

Source: CABIBIOSCIENCE (2018)

In view of globalization of technology in agriculture, there is an impending fear of the spread of the Witches' Broom and Frosty Pod diseases from the South Americas to other regions (Ogunsumi, 2015). Ogunsumi, Okunlola, & Ewuola, (2014) found out that Witches' Broom also known as *Crinipellis, Perniciosa* emerged in cocoa farms in the Upper forest of the Amazon, where it spread to nearby cocoa production regions of Latin America, affecting major production areas including; Ecuador, Brazil, Peru, Columbia, and other minor production areas such as Bolivia, Venezuela, Guyana, Surinam, Tobago, Grenada and Panama.

The introduction of the Witches' Broom to production area can be destructive so far as yield and production is concerned. For instance Ofori-Bah & Asafu-Adjaye, (2011) established consequent to their studies on the spread of cocoa infections that the arrival of the witches ' broom in the late 1980s in Brazil reduced production levels from 400,000 tons to 150,000 tons in a decade. According to Ofori-Bah & Asafu-Adjaye, depending on the application or non-application of cultural control solutions, Witches' Broom disease in cocoa crop can

cause a loss of between 30% and 100%. On the global scale it was estimated that in 2018 alone Witches' Broom accounted for 21% of total production loss to disease (Barbara, et al, 2018).

Crinilla pernicosa do affect youthful growing tissues of the plant, including shoots, flowers and pods. Tougher host are known to be resistant to the infection as their hard tissue is impervious by nature. Young cocoa flushes, mostly the sprouting weakling buds, are scientifically proven to be frail to the infection (Mattyasovzky, 2017).

Black pod disease thrives comfortably in dense cocoa plantations and is a common disease in Haiti for instance (Greco, Oliveira, Demers, & Weise, 2012). Solar radiation neutralizes the potency of the disease, however, cocoa crowed cocoa plantations is contributory factor for which shields sunlight form reaching to the plants and leaves of the shadowed plants. Due to that the black pod vector may be effective and efficient in stifling fruit production as photosynthesis is inhibited consequently consuming parts of the biological energy required by the plant to initiated and complete the process of flowering Greco et al

In West Africa this phenomenon potentially undermines fruit production of the cocoa trees and drastically reduces yields. Moreover, black pod disease development consequent to densely populated farms and plants lacking adequate frequent maintenance, reduces the strength and production capacity of the cocoa (Hill, Carter, & Griffiths, 2014). A combination of negative effects of black pod and denial of solar radiation to cocoa plantation are among the serious issues confronting cocoa industry.

Swollen Shoot common in Africa affect the trees of the crop, it weakens the ability of the plant to support fruits, due to it high tendency of contagion it quickly spread from one infected tree to the other within short times robbing trees of their fertility with immediate effects (Manley, 2012). The Cocoa Swollen Shoot virus portends a serious restriction to cocoa production in Wet Africa, in the World's second largest producer, Ghana has face the menace of the diseases in the early 1940s with serious political implications (Barbara et al). With 2 to 3 years susceptible cocoa trees are killed. Amelonado is a variety of coco species which is known for supplying best quality beans, and it's highly susceptible to the virus's attack (Leiter, 2016)

Though it has existed and operated in West Africa in the 1920s, the Swollen Shoot Virus was identified in 1936, it is example of the newest forms of infection encountered, where the virus emerged from a tree in a forested area and transfers itself to the host cocoa tree where it then begins to expand its tentacles to other trees with a great speed. In Ghana alone during the outbreak episode it is estimated that the country loss annual yield of between 20,000 tons and 120,000 tons from the epicentre of cocoa production in the country. In 1946 and 1974 the average annual loss was estimated to worth £3.5 million (FAO, 2015b)

In spite of our knowledge of the virus and the diseases they cause in West Africa, certain virus particles similar to Swollen Shoot virus have been identified in other cocoa growing regions in Sumatra and Sri Lanka. (Barbara, Janny, & Flood, 2018).

3.10 Sustainable Cocoa production and the adoption of technology (mechanization)

Sustainable agriculture is defined as a new form of technology adopted due to the fact that it distinguishes itself from normal and commonplace agricultural practices. Technology can be defined from varying perspectives. Rogers (1995) defines mechanization or technology as a simple act which ambitions at reaching specific goals through reduction of palpable uncertainty in the face of causal relations. Enos & Park (2008) in their study related to technology and improved productivity defined technology as the general knowledge or information that permits some tasks to be accomplished, some service rendered, or some products manufactured''

Adoption is therefore according to Feder & Umali, (2011) an unending process whereby the mind plays vital role, by considering the stages from the previous contact to the actual integration of the new ways of doing things into every part of the decision making process. In the same way, rationalizing a decision in requires some anticipated competitive advantage in a cocoa farm manager's view point to begin the application or adoption of the new way of production. In fact, Rogers postulates that there is in any case a profound level of advantage relative to the adoption of technology or mechanization in agricultural production over the application of traditional method regardless of its popularity and reliability.

For the purpose of this thesis, cocoa technology would be defined as the overall corpus of knowledge comprising traditional skills and requisite necessary for cocoa production,

processing and marketing. The efficiency and effectiveness of the technologies defined above will be estimated by the improvement in production, processing and marketing.

World cocoa foundation, international cocoa organization and cocoa farmers claimed in 2015 that the cocoa sector is requesting affordable technologies that will enable them enhance the efficiency of smallholder farmers in the sector on their farms. Global demand for cocoa and cocoa derivative rose by 2% on a yearly basis from 2015 to 2019. This call for expansion of existing farmlands was meet with criticism from conservative groups who claim such industrial scale production should not be at the expense of our virgin primary forest and called for farmers to introduce mechanization so as to optimize the existing farmland for massive production (Nieburg, 2018).

Technology in cocoa production can be utilized in the following areas, irrigation to supply water for perennial production, processing to preserve the beans for long time, application of pesticides, insecticides and fungicides to reduce the damage cause to the land and the farmer, financing to provide farmers the opportunity to purchase those requirement that comes alongside with technology, production to ensure that farmers apply the right knowledge to improve productivity, yield, and marketing for producers to produced quality beans that meet international standards (Bauer T. , 2016)

However, as pointed out by Bonabana-Wabbi, (2015), adoption of technology to cocoa farming has been discouraging in the major production areas. He opined that new methods or technologies have been costly. The rate of application of technology, particularly, by smallholders' farmers relies hugely on the financial standing of the farmers, irrespective of their awareness of the monumental dividend they stand to accrue if they apply technologies.

MASDAR (2015) have corroborate this assertion after their study of the application of technology in Ghanaian cocoa farm when they concluded that low adoption of the technologies are due to lack of resources such as money and labour as well as adequate technical knowledge.

Technology adoption is a common feature in the cocoa sector over the last decade as evidence suggests that proper application improves yield, production and fertility of the trees (Kamau, 2016). Corporate bodies and state institutions have establish research institute and

extension outfit where farmers are provided with the knowledge and skills of technology usage (Henderson & Jones, 2014 & MASDAR, 2015).

Considering the massive economic importance that cocoa production plays in their respective economies government have initiated programmes that aims at infusing technology in the sector in order to boost their competitive urge on the global market (Anchiinah, Aneani, Owusu-Ansah, & Asamoah, 2017). One common hi-technological innovation common across West African region is the Cocoa Disease and Pest Control Programme and the high-tech initiative through which governments under the various states cocoa research agencies provide free fertilizers to farmers in the most rural communities (Anchiniah et al, 2017). As part of these comprehensive programmes the government provides labour for the control of swollen shoot disease and black pod.

The mandate of the extension offices in these areas includes a conscious attempt to revolutionalise the traditional methods of farming by inculcating the love for the use of technology into the farmers (World Bank, 2011). The provision of insecticides, fungicides and other items to remotest regions are done are made possible with the use of drones in Ghana. Fertilizers were as part of government's effort to motivate farmers were provided for farmers either on a free of charge basis or subsidy. Planting of hybrid cocoa varieties and proper application of fertilizers are physically taught the farmers by the extension officers.

Application of technology to cocoa farming according to Kebed, Gunjal, & Coffin, (2015) revamped the ailing cocoa sector and enhanced production and productivity in Brazil after the attack by the devastating crop disease ''Fungus witches Broom'' in the 1990s. In an effort to digitally connect cocoa farmers to the value chain in Ivory Coast, the government has committed huge sum of resources into the development of a digitalized system where cocoa beans on the global market are able to be traced to Ivory Coast, this has boosted the country's competitive advantage amidst the keenest of global competition (Edward, 2020).

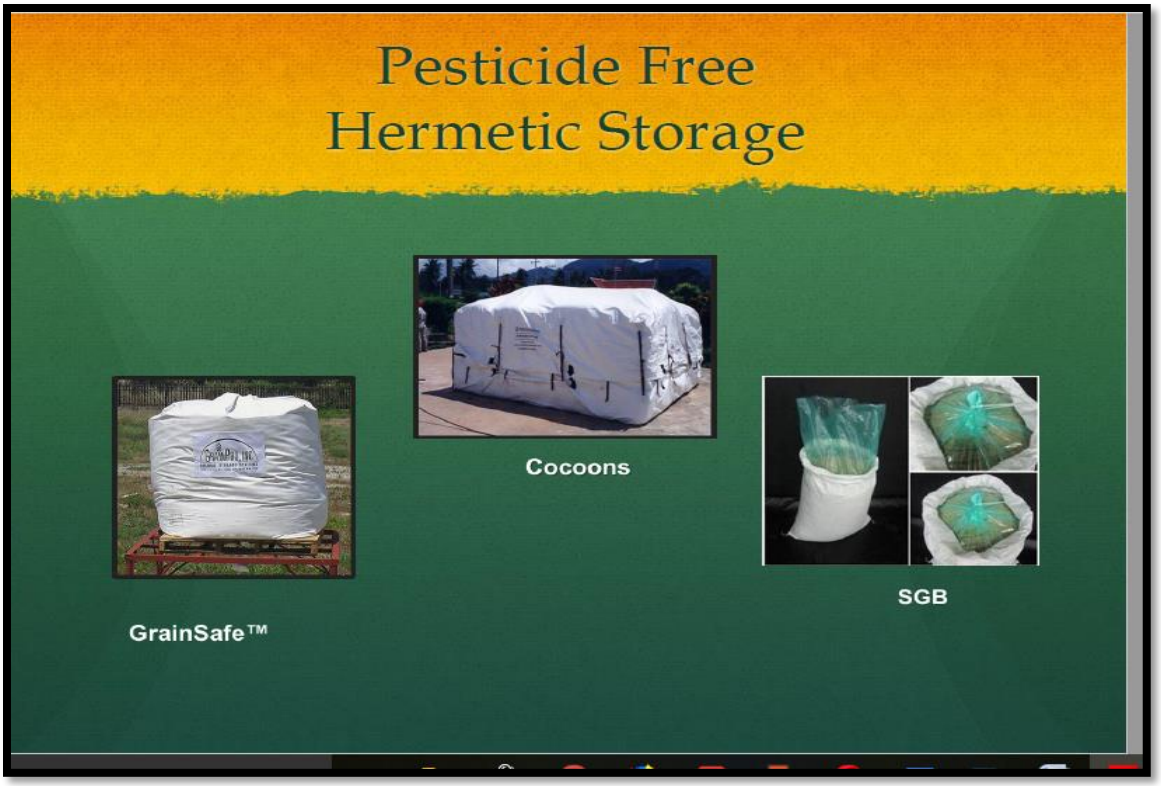
According to Edward, (2020), the reform is reasonable because it will ensure sustainability of Ivorian Cote d'Ivoire cocoa sector. In Ivory Coast this how technology is helping to improve cocoa production. Other measures that combat pestilence, insecticides, and fungicides through technologically inform methods.

In the Americas, technology to improve production and the lives of the farmers centred on the following thematic sustainable areas: basic research initiatives, applied scientific initiatives, diffusion of technology and field application of those technologies on the farms (Anang, 2017) The aforementioned areas of knowledge expected to be assimilated by the smallholder farmers in the regions were channelled through the following practical measures; the basic research initiative was realised within the framework of effective local agents networks comprising of local cocoa farmers, though the technology is extended to other agricultural activities, the focus was much on cocoa production since it is the main legal cash crop in an of the countries in the region (Anang, 2017).

The applied scientific initiative is organized under the auspices of the expert content partnership with experts from scientific institutions. The programme was effective in bridging the technology knowledge gap existing among the farmers. Technology diffusion initiative was carried out by the community knowledge worker, field force management and data collection systems (World Cocoa Federation, 2018).

The pesticides free hermetic storage is a modern way of storing the cocoa beans until it is processed or turned into a finished secondary products, they come in three types; the Cocoons, grainsafe and SGB.

Figure 12: Pesticide free hermitic Storage types



Source: World Cocoa Federation (2018)

Since the introduction of the hermetic storage technology to cocoa farming by the scientific research department of the World cocoa federation, the benefits have been enormous across the entire spectrum of the cocoa production regions (Azikiwe, 2015); firstly, the use of pesticides and fumigation which have serious life implications for uneducated farmers who misapply chemicals have been reduced, particularly, by small farm holders in poor production communities, secondly, the technology has protected the quality, aroma, colour and taste of the beans for longer period of time, thirdly in West Africa where storage was problem, the technology has improved upon both storage and shipping and finally, the hermetic storage technology has guaranteed income and food security for farmers (ICCO, 2015)

The need for perennial production and processing of cocoa beans was a vital decider in the need to adopt technology to cocoa production (ICCO, 2015). Due to the unpredictability of the weather and the propensity for disappointment in times of need, a system of solar drying was harmonized into the bunch of technological initiatives for enhanced cocoa production,

processing and marketing. The solar drying equipment captures and stores light energy, for later usage. In Ghana, Nigeria, Cameroun and Ivory Coast the technology is rarely used due to the nature of the climate, however, in the Latin Americas and Asia and other humid areas, the technology is of monumental importance to the farmers (Gayi & Tsowou, 2016)

The implementation of the hermitic storage system and the solar drying tools has encountered challenges for farmers from poor producing countries (Kolavalli & Vigneri, 2017). These technologies which have proved to have impact of areas intended for, yet, problems such as; cost of the technological framework for concretizing the programmes, educating and training of farmers, logistics and tariffs are the major impediment to the spread and adoption of the technologies. The technologies have improved the systems of data collection on discovered diseases and pest by farmers, through the use of another mobile application technology which allows farmers to report discovered defects on their farms for rapid response (Losch, 2017)

Again cocoa inputs distribution networks have seen tremendous improvement as a result of technological revolution in the cocoa sector, expanded partnership between cooperative bodies sharing ideas and knowledge, and improved productivity and production have been recorded in areas where technologies have been fully embraced by the farmers and the managers of the farms, compared to areas where traditional methods of farming and combating diseases and pest are still predominant (Panlibuton & Lusby, 2016).

Cocoa production is likely to be affected in various ways by the anticipated impacts of global warming (CIAT, Reuters, 2011). Specific concerns have been raised with regard to the future of cocoa production as a major cash crop and sustainers of the economy of the current major producing countries in West Africa. It has been argued that if the rises of the temperatures do not subside, West Africa where the major producing countries are located could be declared redundant for the production of cocoa (Stecker, 2011). In terms of prices risk too, the outbreak of the Coronavirus in Europe and America, the most important consuming regions for chocolate, could undermine demand and reduce cocoa production from the major producing areas. According to Meyers & Gillett (2020),the relax in the demand for the raw materials for manufacturing chocolate classified in the HS 1801 will likely influence cocoa future prices in the upcoming months.

It could be confidently concluded, that the introduction of mechanization/technology to cocoa production is not only for the purpose of maximization of production, productivity and improvement in the lives of the farmer, it is also needful to safeguard the primary forest by reducing the rate of destruction of the scarce land we have. To the state, technological application to cocoa production guarantees enhancement in yield, this will increase the contribution made by cocoa in their economic growth, particularly in countries where cocoa is the backbone of their economy, and major contributor to their GDP growth. The use of technology will encourage people to get into farming thereby tackling the unemployment quagmire these countries find themselves in.

Considering the number of people employed in the cocoa production sector, particularly in West Africa, improvement through effective application of technology will help the country rectify most of its social ills besetting their economies, tackle rural urban migration, reduce emigration, ensure food security, mitigate criminality and to improve the overall living conditions of the people.

In the face of the global competition by producing countries inspired by the growing demand for cocoa and cocoa derivatives, governments of producing countries are committed to remaining forces to reckon with in the global cocoa market. For countries to enhance their value on the value chain, they have injected huge resources into technology, with the hope that the use of technology will enhance their competitive urge on the global market.

The application of technology to cocoa production takes the form of production, processing and market. The interest of the small holder farmers who is the major stakeholder cannot be overridden when designing policies that final requires their commitment. The participation of the farmers in the discussion of technological adoption is indispensible in evaluating the success of it. Considering the continuum of roles of technology to the country, and the fact that successful implementation of any technology in cocoa production rest on the commitment and readiness of the farmer, how then has the farmer been participatory in designing and implementation of state policies towards mechanization in the cocoa.

In the ensuing chapter the researcher looks at the benefit of mechanization in cocoa production to the country by considering production stock from all the major producing regions in the country and based on that forecast production in the years ahead, while it also

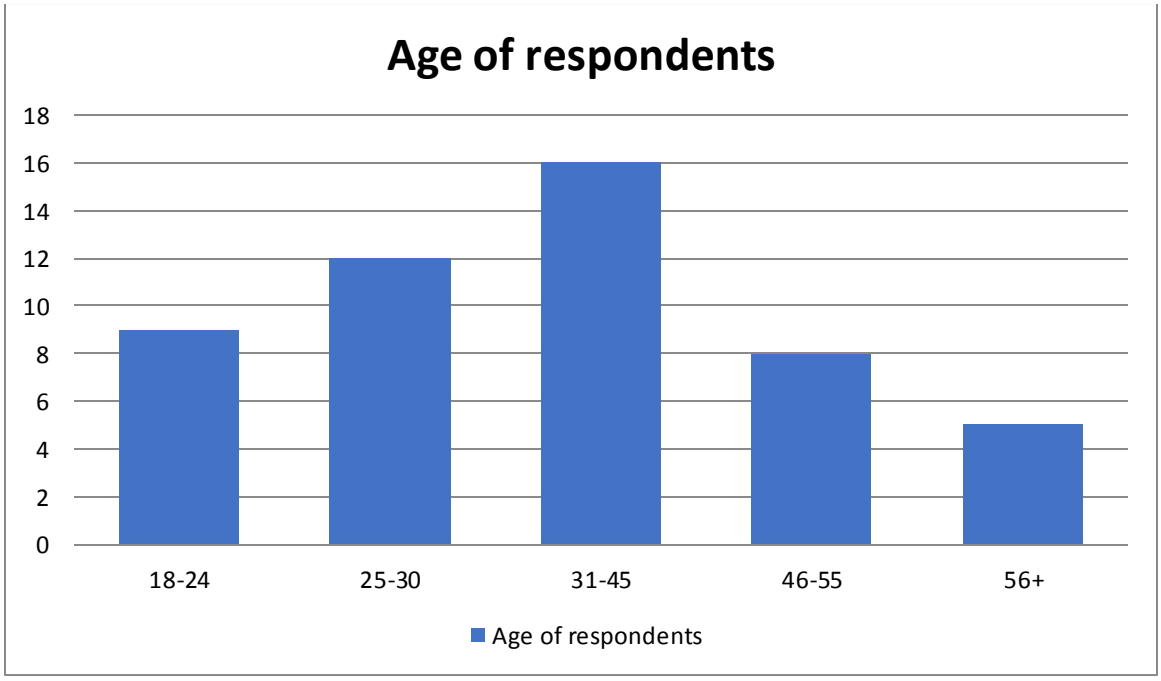
evaluates the extent to which the interest of the poor farmers has been realised in the whole scheme of government policies vis avis international marketing forces this will be achieved through a model of Participator Rural Approach (PRA). Challenges that confront the business of cocoa production, processing and marketing will be investigated; this will be achieved through the analysis of strength, weaknesses, opportunities and threats (SWOT) in the cocoa business.

4 Own research and analysis

Under this chapter, the researcher discusses the results of the thesis comprehensively taking into account the objectives of the study. Descriptive tools such as frequency and percentage tables, graphs in the form of were adopted for the analysis and presentation of the outcome. The findings were accurately congruent to the specific objective to the study.

4.1 Demographic analysis of respondents

Figure 13: Age of respondents (Farmers)



Source: Field survey (2020)

From the analysis on the figure 8, it was found out that 9 representing 18% out of the 50 farmers who participated in the study were persons between the ages of 18-24. And again 12 respondents representing 24% ranged between 25 and30, with 16 representing 32% were those within the age range of 31-45. It was also found out that those within the age of 46 and 55 representing 16 were 8 in number whiles the minority of the participants who were 56 years and above were 5 in number representing 10%.

It could be concluded that farming is dominated by a cohort of the age between 18 and 45 follow by those within the ages of 46 and 55. The aged were identified to represent a minute section of the farming folks in the study area.

Table 8: Gender distribution of farmers

Gender	Frequency	Percentage (%)
Male	35	75
Female	15	15

Source: Field Survey (2020)

From table 6 it was discovered that 35 representing 75% of the participants were male while only 15 representing 15% of them were females. Explanation that was given for the male dominated phenomenon was that since farming in rural communities such why the study was conducted is mainly done with simple traditional tools, of which according to some of the respondents females are incapable of managing. As traditional community women are customarily not allowed to own cash crop farm such as cocoa farms, so even if they own they prefer to make their husband owners.

Farming with manual methods which is a commonplace practice in the study area is demanding and as such females have hard time engaging in commercial scale farming.

Table 9: Educational status of respondents (%)

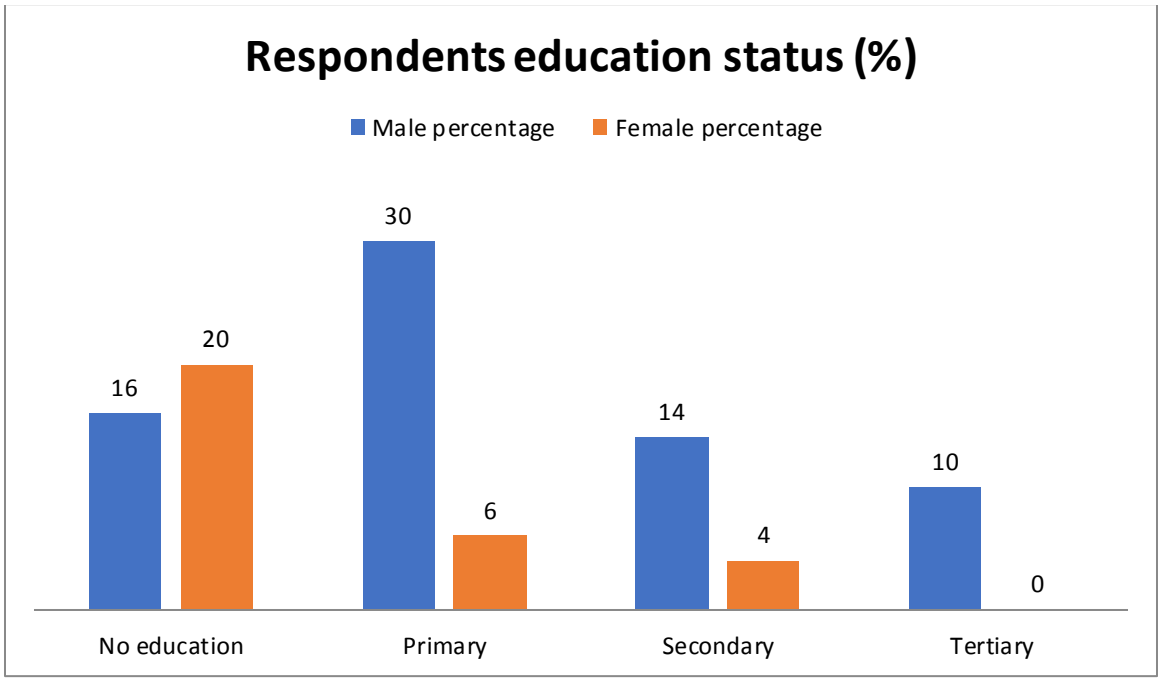
Education status	Male	Female	Percentage (M)	Percentage (F)
No education	8	10	16	20
Primary	15	3	30	6
Secondary	7	2	14	4
Tertiary	5	0	10	0
Total	35	15	70	30

Source: Field Survey (2020)

Table7 discusses the education level of respondents within the context of formal education. The discussion was informed by the exigency behind farmers' requirement to assimilate and apply technology to farming. Extension officers provide knowledge and information on scientific application of supplied inputs on the farms, since. The study hypothesised that the role of technology/mechanization is vital for the enhancement of the countries importance on the global value chain in the midst of highly contestable market.

The table revealed that only 30% of the female farmers have undergone any form of formal education as against 70% of men. With tertiary education, probably the best status to determine the aptitude level of the farmers to grasp instructions related to the usage of technology on their farms, it was identified that none of the female farmers qualified. The males had 10% being tertiary graduates. Farmers ability to take inventory of their tools, keep records of inputs and output rest on their ability to read and write.

Figure 14: Respondents' educational status in percentages (%)



Source: Field Survey (2020)

In view of the commercial importance that cocoa production serves the country, governments over the years have contributed financial and logistics supports in the form of credits, farm inputs and training programmes under the tutelage of the extension offices. Government is

the major buyer of the coca beans under the auspices of the Ghana Cocoa board (COCOA BOARD). Prices are fixed by the board and it the sole regulator of prices in the country. The role of existing horizontal companies does not extend beyond the country. They buy from the local farmers directly and sell to the government. These horizontal integrative companies provide incentives for farmers to guarantee them of purchases in the cocoa season, some of the incentives include pre-financing capital and other inputs.

Farmers are assured of such sponsorship only when they are members of cooperative bodies form by these companies. Some of the farmers who are capable of financing their projects do not rely on the benevolence of these companies. The research was interested in finding out how many of the farmers are members of the association in order to determine their source of capital.

Table 10: Farmers years in associations in percentages

Years of membership	Frequency	Percentage (%)
8	6	12
9	4	8
10	2	4
11	3	6
12	4	8
13	4	8
15	5	10
16	4	8
17	6	12
18	4	8
19	4	8
20	4	8
Total	50	100

Source: Field Survey (2020)

The study revealed that all the farmers belong to an association. Belonging to an association meant sure guarantee of pre-financing loan and credit for farmers. It was identified that the sole reason why farmers join association is to qualify them for loans and credits. Table 8 indicates the frequency of farmers who belong to cooperation.

Farmers indicated that loans from the companies are adequate for them that they do not have to invest their own money into the farm, particularly for the fear of loss in production, as a result of natural forces and misapplication of chemicals.

Table 11: Source of capital for farmers

Source of capital	Frequency	Percentages
Self	0	0
Loan	0	0
Cooperative membership	50	100
Total	50	100

Source: Field Survey (2020)

Cooperative membership is a sure way of market guarantee and it is mandatory for members to be entitled for loan facilities from the bodies in other to finance their farming expenses. In the analysis on the table 9 it was identified that almost all the small holder farmers receive capital from their membership to the cooperate bodies. The Ghana cocoa board does not purchase cocoa beans directly from individual farmers.

4.2 Analysis of Cost, revenue and profit of cocoa production by farmers

Participants cost of production per each season and revenue obtained from production varied from each other. The farm size determined the size of labourers hired, therefore due to difference in farm size, financial inputs consequently differ from each farmer, this in a way impact on revenue size for each farmer.

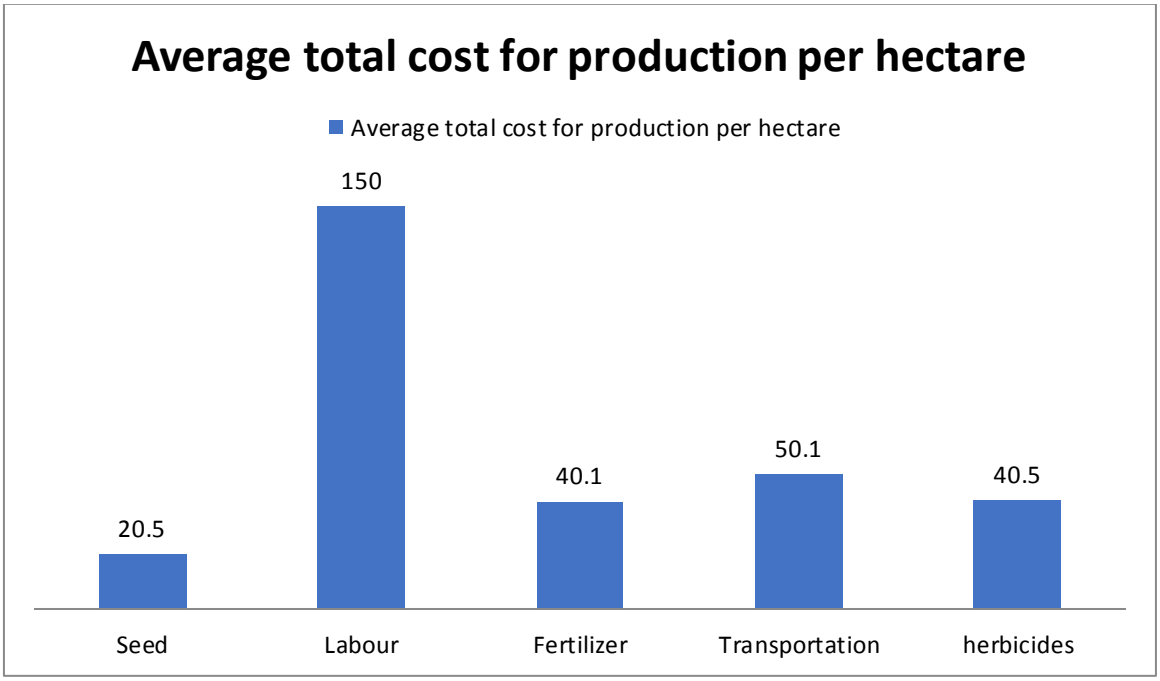
The variable cost for hectare of farm was calculated as being the average of the overall cost of inputs such as seeds, labour, fertilizers and chemical components to combat pests and diseases. Farmers indicated that government subsidy for inputs meant much for their expenditure. On the tables below the average cost per hectare, profit and profit cost ratio was given.

Table 12: Average Total cost of production per hectare in cedis

Item	Average total cost per hectare
Seed	Ghc 20.5
Labour	Ghc 150
Fertilizer	Ghc 40.1
Transportation	Ghc 50.1
herbicides	Ghc 40.5
Average Total cost for production	Ghc 300.7

Source: Field Survey (2020)

Figure 15: Average total cost for production per hectare



Source: Field Survey (2020)

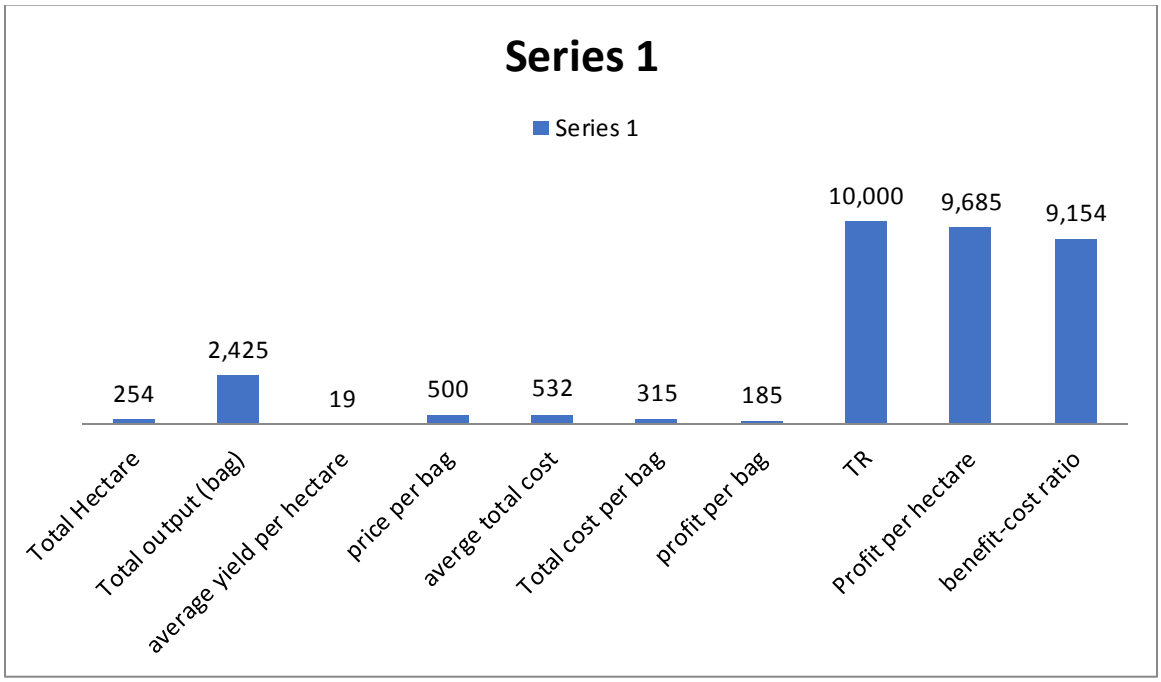
Table 13: Summary of cost and benefits in cedis

Items	Value
Total hectare	Ghc 253.8
Total output per hectare (bags)	Ghc 2428.2
Average yield per hectare	Ghc 19.2
Price per bag	Ghc 500
Average total cost per hectare	Ghc 532
Total production cost per bag	Ghc 315
Profit per bag	Ghc 185
TR(average yield/hectare*average	Ghc 10000

price per bag	
Profit per hectare (TR-TC)	Ghc 9,685
Benefit-Cost ratio	Ghc 9,154

Source: Field Survey (2020)

Figure 16: Summary of Cost and Benefits



Source: Field Survey (2020)

The figure10 present the summary of the profit-cost ratio of production of cocoa in the Amenfi West district collated from the respondents.

Total hectare cultivated by all the respondents amounted to 253.8ha. 2,428.9 bags were made by all 50 respondents in 2018/2019 season, with average yield per each farmer being 19.2. The price per bag according to 2018/2019 pricing regulation was Ghc 500.00 with. Financial and labour cost for cultivating a hectare of cocoa in the Amenfi West was estimated at Ghc 5,320 with a total cost for producing one bag of cocoa being Ghc 315.00, therefore the profit gained by each farmer on a bag of cocoa produced was Ghc 185.00. Profit per each hectare was Ghc 9,685.00 with benefit cost ratio for the production of 253.8 hectare of cocoa was Ghc 9,154.00.

This means that cocoa production in the region is a massive profitable economic venture. Prior to the time when farmers have to fully fund their production, production cost exceeded Ghc315.00 per a bag of cocoa (Obiri, Geoff, Morag, Anglaare, & Cobbina, 2018). Other expenses such as those invested in disease and pest control, sale of fertilizers, herbicides and other inputs have been waived in the form of subsidies by the government (Asare, 2016). Free mass spraying, extended progressive education on the use of technology in farming and the role of the various stakeholders that ensure vertical and horizontal integration have augmented the gains for farmers (Ahenkora, Akrofi, & Adri, 2017). Discovered diseases and pests, provision of hybrid and viable seeds for the farmers by the Cocoa Research Institute of Ghana (CRIG) have improved farmers practical knowledge in farming and consequently enhanced productivity and production (Ha-Jong, 2012).

4.3 Constraints to cocoa production in Ghana

The Ghanaian cocoa sector is not immune from problems that restrict successful harvesting seasons. Just like any agriculture activities in the country the cocoa industry is riddled with a lot of formidable problems. In Ghana the average production is estimated at 400 kilogram per hectare putting the country among the lowest globally (Wilson & Cryer, 2019). Poor yields results in discouraging profitability in the industry thereby undercutting the economic capability of the farms and stifles sustainability effort of the communities.

A multitude of problems affects productivity in the cocoa industry. One of the major issues often out of the control of the farm is climatic conditions. Climatic conditions though, is considerable in the major cocoa growing regions, it is not uncommon for the climate to disappoint farmers at periods where the opposite of the current weather conditions is preferred (Reay, 2019).

In their studies Hinneh, Enoch, Davy, & Dewettinck, (2019), demonstrated that among the limiting factors for increased yields in the cocoa industry included improved farm managerial skills such as control of pest and diseases, proper application of fertilizers and herbicides and pruning of excess branches harbouring pest and disease habitats.

Excessive and inadequate rainfall and sunshine were identified by Kongor & Boeckx, (2018) as problems that have over the years disturb farmers in rural cocoa farming

communities in Ghana, where irrigation cannot be afforded by them. Reay, (2019) pointed out that low cocoa yields in Ghana is the old age of many of the trees. A trees potency for effective yield peaks at 18 years, nonetheless, according to Adeniyi, (2018) almost a quarter of cocoa trees in Ghana are more than 30 years. Black pod diseases, drought and climate change, low producer price and corruption pose great threat to the industry (Wegbert, 2015). Misapplications of pest and disease management technologies are seen as problems directly threatening the crops and the lives of the farmers.

4.4 Results of own research

(SWOT) is a tool used to examine the strength, weakness, opportunities and threat that punctuate activities of varying nature, being projects, business, political or entrepreneurships. Strengths and weakness con be considered as intrinsic features. Strengths underpin advantages and weakness is considered the summary of disadvantages. Opportunities and threats are extrinsic features. We define opportunities as existing opportunities provided by the environment within which the project is being undertaken.

The object of the manager is to grab the advantage that is offered by the environment as defined as opportunities to augment efficiency and maximize dividend. Threats on the other hand are forces that threaten the success of the project over which the manager has absolutely no control. According to Glaser & Anselm, (2008) threats, unlike opportunities are likely to cause major setback to the project, business of institute.

4.4.1 Strength of production

In the analysis, strength was regarded internal features of the cocoa industry which could lend itself to the farmer for profit and improvement of the cocoa industry in the study area. Some of the strengths identified have been catalogued in the Table.

Table 14: Strength of production

Biophysical strength

1. Quality and viable variety of cocoa bean grown. Criollo is the variety grown in the region, a variety with international ratings.
2. Organic cocoa cultivated, unless there is an outbreak of disease farmers do not apply chemical fertilizers and pesticides
3. Farmers farm on family lands, devoid of litigation and incursions by unauthorized persons
4. Vast size of the farming land is wetter and so could sustain production when precipitation falls

Managerial strengths

5. The role of extension offices have improved the attitude of farmers towards good farming practices
6. Cocoa cultivation occurs side by side with other crops that subsist the lives of the farmer.

Source: Field survey (2020)

Non-congested land was used to refer o the fact that excessive availability of land in the area was deemed strength since it promises of future extension of production land. Improved farmers attitude towards farming practices is an indication of improvement in the farmers' optimism toward profitability of the venture

The problem of soil decline through indiscriminate farming is considered to be curbed by the system of agro-farming practice by the farmers.

4.4.2 Production Weakness

The weaknesses that were identified in the study have been catalogued in the table below.

Harvesting immature fruits and the use of inappropriate farming equipment, such as jumping and climbing trees to pick fruits, were found to be some of the unacceptable practices used by the farmers. Climbing trees poses a serious threat to the buds and flowers that have sprout on the trees. Automatically such development may and do affect adversely the next production.

The use of traditional means such as cutlasses to prune rather than approved tools was confirmed by some of the respondents. Whiles such practice presage danger for the farmer it also threatens the lives of the trees.

With regard to renovation of cocoa farms, most of the cocoa trees are half a century old. Ideally a cocoa tree must be replaced after 18 years of existence from the time it was planted.

Old trees were plentiful in most of the farms and this pose a real threat since old trees tend to have lower yields. Generally, cocoa farmers complain of not having financial capacity to buy the right tools for effective maintenance of their farms. While it was identified that most of the farmers resort to their untreated cutlasses for pruning which allows water to be stored in some part of the plant some of the farmers have old secateurs for pruning.

Table 15: Production Weakness

Biophysical Weakness

1. Bad agricultural practices, eg unorthodox way of harvesting and wrong pruning
2. Lack of agricultural tools to do maintenance work.
3. The old age of most of the trees
4. Non-existence of cocoa processing plants

Managerial Weakness

5. No maintenance and renovation of exhausted cocoa farms
6. Restricted access to the existing global technology for cocoa farming
7. Poor productivity
8. Lack of archives on production
9. Lack of technology to trace beans to farmers in the region
10. Lack of information on the variety of cocoa beans so as to make the right choice

Source: Field Survey (2020)

Farmers who participated in the study have confirmed the role of prevent companies, international non-governmental organizations in collaboration with ministry of agriculture in assisting their effort in production. The farmers concurred with an item in the guide that prices increment has been fought on their behalf by some civil societies which share in their struggle.

4.4.3 Production opportunities

Global markets for cocoa products from Ghana is considered as opportunity for cocoa production in the region and Ghana as well as the World demand exceeded the Ghanaian cocoa industry in the periods 2017/2018 and 2018/2019 seasons. Cocoa production is increases when yield increases depending on the commitment by farmers to adequately maintain their farm. Despite the fact that Ivory coast leads the World in production, the quality of Ghanaian beans maintains Ghana's beans as the much sought by consumers with great taste spots. The managerial skills proved by the managers in terms of grindings, is purely traditional, where the beans are allowed to undergo natural means of fermenting, this maintains the natural aroma that promises of quality taste.

Table 16: Production opportunities

Socio-economic production opportunities

1. NGOs participation and government support in cocoa production
2. The provision of incentives and technical support by purchasing companies
3. Seedling provision by some institutions
4. The presence of experts in the field of cocoa farming

Managerial production opportunities

5. Opportunity for production and yield improvement
6. Markets opportunities for quality Ghanaian cocoa beans on the World market

Source; Filed survey (2020)

4.4.4 Production Threats

Inadequate or lack of targeted programmes that incentivize farmers tends to pose a dangerous threat as those programmes risk sideling pressing issues of a magnitude for the farmers who are the major stakeholder in the industry. in the face of the progressive activities of the horizontal companies and the help of non-governmental organizations. It was pointed out by the farmers that some of them have inadvertently become major standing blocks to their activities.

The existence and operations of some of these bodies robs the local farmers of their freedom of autonomy. Local farmers rely on initiatives of exotic projects in their production enterprises; this is dire for the future of the farmers if these companies are no more. The farmers could not show any initiative from them, local innovations to mobilize ideas and spearhead local development have been undermined.

Participants have indicated that local farming practices have in most case fallen out of sync with projects imposed on them, for instance some of the seedlings supplied them by these bodies do not work perfectly with local agricultural practices. Consequently low quality seedlings which do not do well after transplanting are provided them.

Table 17: Production Threats

Biophysical Threats

1. Harmattan and climate variations
2. The activities of rodents
3. Adamant to change by farmers
4. Diseases infections. Eg swollen shoot, black pods and witches' broom

Socio-economic threats

5. Lower producing prices, denial of the right to regulate prices
6. Defects of incentives provision companies
7. Delay in inputs by government
8. Farm owners lack of commitment to the farm at the expense of caretakers
9. Cocoa smuggling
10. Corruption in government
11. Corruption in purchasing companies

Source: Field survey: (2020)

4.4.5 Factors impacting the profitability of cocoa famers in the Amenfi West District

The following table presents the regression analysis of profit of function of cost of inputs such as seeds, fertilizers, labour, revenue, age of farmers and their educational status. For the purpose of the analysis, the coefficient determination R2, that t ratio and the magnitude of the projected coefficient (R2).

Table 18: Regression Analysis for the variables

Profit	Coef.	Std.Err	T	p>|t|
Cstsed	-0140544	.0047481	-2.96	0.006
Cstfert	-0107644	.005258	-2.05	0.049
Labcst	-.1067967	.0531802	2.01	0.054
Fage	-.0354301	.2370877	-0.15	0.882
Educh	71.9664	13.91786	5.17	0.000
No of obs=75, prob>F=0.000, R-squared=0.6765, Adj R-Squared=0.6118				

Source: Field survey (2020)

This is an indication that more than 70% of the variability of the dependent variable is explained by the explanatory variable in the analysis. It was found out that the level of education was positively related to profit of farmers. Connotatively, the increase in level of education increases profit for farmers and vice versa. The costs of inputs such as seeds, fertilizer and age of farmers have adverse impact on profit generation per the regression.

It suffices to point out base on the outcome of the analysis that increase in the cost of any of the inputs directly accounts to the decrease in profit for farmers. And a reduction in the cost any of the following; seed, fertilizer, labour and farmers age will result in the increase in profit. Since the p> |t| is less than 5, per the statistics we can conclude that the cost of seeds, the level of education of farmers and the cost of fertilizer are statistically significant. All the three viable discussed do strongly influence production and profit by and large

The findings showed that farmers have mixed feeling when it comes to farming; this was made clear during the analysis of the SWOT. Financial problems that beset the farmers are partially taken care of by the corporate bodies that also have personal interest in the sector. Delays in government inputs, cocoa pilfering for smuggling, corruption in government and lower producers' prices are among the socio-economic threats confronting the farmers.

Drought (harmattan), the activities of pest and rodents, climate variation that affect rainfall expectations, diseases and pest are some of the problems mentioned in the questionnaires. Farmers indicated that the activities of companies and state institutions with regard to mechanization have been worthwhile. It has improved their understanding of technology in farming.

It is highly recommended that government doubles its effort in the mitigation against the onslaught of diseases and pest. Invest in irrigation system to ensure year round production. The provision of subsidize inputs should as much are possible be made entirely free for farmers.

Education of farmers to embrace technology should be encouraged in the farmers, again the cost of inputs, the level of education in farmers, as well as readiness to adopt to change should be prioritized by stakeholders.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5 Conclusion

Cocoa production in Ghana is a major source of employment for the country. it provides a livelihood for over 800, 000 people across the length and breadth of the country.

Farmers who are the major stakeholders in the industry are confronted with a variety of problems that in the long run affects production. Government have major stake in the future of the industry so far as cocoa production is concerned. Due to these policies reforming the sector have seen tremendous improvement in production, evidenced in production difference in 2017/18 and 2018/2019.

The SWOT analysis proved that internal circumstances such as fertile land, family lands used for farming, the availability of quality variety of seeds and provision of education to farmers enabled farmers to produce more beans. On the weakness aspect, it was identified that lack of zeal on the part of farmers to adapt to change, diseases, pest, robbery, corruption and climate change are factors that inhibit production. opportunities offered by the international market in the EU and the Americas motivates farmers to produce more, as motivation in this form is vital for increase yield through the effort of the farmers. Companies, NGOs and purchasing companies provide incentives for farmers to meet some of their needs and this was identified as a form of opportunities to be utilized by the farmers.

Farmers' innovative skills are blunt due to overly reliance on these companies who initiate their own programmes and foist it on the local farmers. It was identified that the autonomy of the local farmers are undermine as foreign companies take over the challenges on behalf of the local farmers.

Education was found out to be a major factor for production. The higher the level of the farmers education the more they are able to abide with technological instructions. The cost of inputs, such as fertilizers, seedlings, labour is related to the rate of production. The higher the cost of these inputs the lesser farmers are able to produce. Reduction in the cost of these inputs translates into higher production.

5.1 Recommendations

The study found out that major setbacks to effective and efficient cocoa production in the Amenfi West district included technological challenges, lack of financial capacity to emancipate themselves from the control of private companies. In view of this the study recommends the following

Pre-financing by government: Government of Ghana must provide capital for farmers to be able to meet the financial obligations during production, harvesting and post harvest; this will protect their autonomy to decide which purchasing company to deal with and not to be coax into joining association against the wish.

Producer prices: Government can fight effectively the phenomenon of smuggling by raising the producers' prices for farmers; this will stop them from smuggling cocoa beans to Ivory Coast at a better price. There should be a collaboration among the largest producers in West Africa to form an association to determine producers prices that inures to the benefit of the farmers, rather than prices being regulated by buyers

Timing provision of inputs: The provision of subsidized inputs must be timely in order to encourage farmers to treat diseases and pest as they want far too long before.

Technological innovation: Stakeholders in the industry should speed up the inculcation of technology in the farmers. This will boost productivity and safe farmers from needless cost. Irrigation should be the priority of the government. Government should invest and encourage irrigation; this will mitigate the impact of climate change and ensure production through the year.

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APPENDIX

Appendix 1

SURVEY QUESTIONNAIRE FOR COCOA FARMERS IN AMENFI-WEST DISTRICT

Serial Number……...

Date... Time: Start... End: .....

Town/Village.

Demography of farmers

1. Gender: ( ) Male ( ) Female

2. Age of Farmer (years)…..... 3a. Marital Status: ( ) single ( ) married ( ) divorced ( ) widow ( ) widower

4. Citizenship: ( ) Native ( ) Migrant (Origin: .....)

5. Age of farmers (a) 18-25 (b) 26-35 (c) 36-45 (d) 46-55 (e) 56+

Formal education: level: (a) No education [ ] (b) Primary [ ] (c) Secondary [ ] (d) tertiary [ ]

Number of farming experience (a) 4yrs [ ] (b) 10yrs [ ] (c) 15yrs [ ] (d) 20yrs [ ] (e) 25yrs [ ]

Member of any cooperative association (a) Yes [ ] (b) No [ ]

What form of benefit do you derive from the group (a) financial [ ] (b) ready market [ ] (c) farming inputs [ ]

What are your sources of capital for farming (a) self-financing [ ] (b) loan from bank [ ] (c) cooperative membership [ ]

What form does government participation take (a) free inputs and advice [ ] (b) subsidize inputs and advice [ ]

Are you comfortable with the time subsidized input are made available to you (a) no it delays (b) yes it comes at the right time.

Do the activities of corporate bodies undermine your sense of innovation (a) yes it does (b) not it does not

SWOT analysis

What are some of the positive things that you realized in your years of farming experience in cocoa production that you wish it remains? Please mention two things

……
……

What are some of the things that have been creating difficulties for you as a cocoa farmer that makes farming not enjoyable to you? Please mention two things

……
……

Are there some opportunities attached with cocoa farming that you think other crops do not have? Please mention any two

……
……

What are some of the things threatening the future of cocoa production in Amenfi-West district that you think needs immediate attention by government? Please mention two

……
……

There are three varieties of cocoa beans which one do you think is much reliable in terms of its viability and production capacity?……

Ghana has increased its production record massively in the last two seasons on the global market, what do you think accounts for that trend? ……

How do you benefit from your membership with the association the cooperative you belong?

……
……

What does the government encourage mechanization in the sector ?

……

……

Appendix 2

Map of cocoa producing regions in Ghana