Czech University of Life Sciences Prague

Faculty of Economics and Management

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Bachelor Thesis

Analysis of Cocoa Production

Author of the thesis

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Thesis title

Analysis of Cocoa Production

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BACHELOR THESIS ASSIGNMENT

Ruth Odamea Anim

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Objectives of thesis

This study analyses the production on of cocoa in the top three cocoa producing countries; Côte d'Ivoire, Ghana and Indonesia. The study specifically seeks;

1. To analyze agricultural commodities on the market.

2. To analyze the factors that affect cocoa production.

3. To analyze the prices of cocoa production.

Methodology

The study empirically analyzed the factors that affect produc on and price of cocoa in the topthree leading cocoa producing countries in the world by employing a mul ple regression model.Secondary data was used for the purpose to meet the set objec ves of the study. Data wascollected from the Food and Agricultural Organisa on (FAO), World Bank (WB), Ghanasta s cal service (GSS), Ghana Cocoa Board (COCOBOARD), Interna onal CocoaOrganisa on (ICO) and the World Atlas.

Other related literature which were relevant for the study to reach the aim of the study. Reportsand other books were also used in the study

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40 pages

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Cocoa, Agriculture, Côte d'Ivoire, Ghana, Indonesia, Cocoa contract, Cocoa prices, Intercon nental exchange, Cocoa Produc on

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Recommended information on sources

Acquaah, Benjamin. Cocoa Development In West Africa. Accra: Ghana Universities Press, 1999. Print.

Asase, Alex, Kwasi Ofori-Frimpong, and Patrick K. Ekpe. "Impact Of Cocoa Farming On Vegetation on In An Agricultural Landscape In Ghana". African Journal of Ecology 48.2 (2009): 338-346. Web.

Mananyi, Anthony and John J. Struthers. "Cocoa Market Efficiency: A Cointegra on Approach". Journal of Economic Studies 24.3 (1997): 141-151. Web.

Neilson∗, Jeff. "GLOBAL MARKETS, FARMERS AND THE STATE: SUSTAINING PROFITS IN THE INDONESIAN COCOA SECTOR". Bulle n of Indonesian Economic Studies 43.2 (2007): 227-250. Web.

Syrovátka, Pavel and Samuel A. Darkwah. "Models Of Price Development On World Market For Cocoa Beans". Acta Universita s Agriculturae et Silviculturae Mendelianae Brunensis 56.3 (2014): 201-210. Web.

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Declaration

I declare that I have worked on my bachelor thesis titled "Analysis of Cocoa production" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 14.03.2017   _____

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Analýza Produkce Kakaa

Souhrn

Cílem bakalářské práce je nalézt faktory, které ovlivňují produkci, jakož i cena kakaa na prvních třech zemích produkujících kakao na světě, a to; Pobřeží slonoviny, Ghana a Indonésie. Studie použila vícenásobného regresního modelu (metoda nejmenších čtverců) analyzovat determinanty produkce kakaa a ceny v prvních třech zemích produkujících kakao na světě. Vícenásobná regrese byla provedena na šestnáct let časové řady údajů od roku 2000 do roku 2016 chvilkách s ohledem na rozdíly ve vývoji mezi zeměmi studie napříč sledovaného období. Údaje použité byla získána z databáze uznávaných mezinárodních a regionálních organizací, jako jsou potraviny a zemědělství (FAO), Světová banka (WB) a Ghana statistických služeb. Výsledky získané z vícenásobné regresní analýzy vyplynulo, že vládní výdaje, zlepšení technologie, půda k dispozici pro výrobu a výrobní náklady významně ovlivňuje produkci kakaa ve všech třech sledovaných zemích. Na cenové straně bylo zjištěno, že směnný kurz a cena konkurenčního komodity výrazně ovlivnit cenu kakaa v zemích studie. Analýza však ukázala, že inflace neměl žádný významný dopad na cenu kakaa ve všech třech sledovaných zemích. Na základě výsledků studie založené bylo zjištěno, že faktory, jako vládních výdajů, zlepšení technologií, volných ploch pro výrobu a výrobní náklady byly považovány za determinanty výroby chvíle směnného kurzu a ceny konkurenceschopné komodity (káva) významně ovlivnit cena kakaa a tudíž jsou považovány za determinanty kakaa cenu. Je proto důležité, aby tvůrci politik různých zemí studovali, zavádí politiku, která bude na modernizaci kakaa průmyslu a zemědělský sektor jako celek na základě získaných výsledků studie.

Klíčová slova: Kakao, produkce kakaa, světová cena kakaa, metoda nejmenších čtverců, regresní model, ekonomika, rozvoj, zemědělství, půda, příjmy.

Analysis of Cocoa Production

Summary

The aim of the bachelor thesis is to find the factors that affect the production as well as the price of cocoa in the top three cocoa producing countries in the world, namely; Cote d'Ivoire, Ghana and Indonesia. The study used a multiple regression model (Ordinary Least Square) to analyze the determinants of cocoa production and price in the top three cocoa producing countries in the world. The multiple regression was done on a sixteen years' time series data from 2000 to 2016 whiles considering the difference in development among the countries of the study across the study period. Data used was obtained from the data base of recognized international and local organizations such as Food and Agriculture Organization (FAO), the World Bank (WB) and Ghana statistical services.

Results obtained from the multiple regression analysis showed that, government expenditure, technology improvement, land available for production and the cost of production significantly affects the production of cocoa in all three studied countries. On the price side, exchange rate and the price of a competitive commodity were found to significantly affect the price of cocoa in the countries of study. However, the analysis showed that, inflation had no significant impact on price of cocoa in all three studied countries.

Based on the findings of the study, factors such as government expenditure, technology improvement, land available for production and the cost of production were deemed as determinants of production whiles exchange rate and the price of a competitive commodity (Coffee) were found to significantly affect the price of cocoa and hence are deemed as determinants of cocoa price. It is therefore important for policy makers of the various countries studied, introduces policies that will revamp the cocoa industry and the agricultural sector as a whole based on the obtained results of the study.

Keywords: Cocoa, Cocoa production, World Cocoa Price, Ordinary Least Square, Regression model, Economy, Development, Agriculture, Land, Income.

Table of Content

1 Introduction

Agriculture is extracted from Latin words Ager and Cultura. Ager means land or field and Cultura means cultivation (Manonmani, et al., 2013). It is also referred as the science of producing crops and livestock from the natural resources of the earth ((Reardon, et al., 1999). The primary aim of agriculture is to cause the land to produce more abundantly, and at the same time, to protect it from disintegration and misuse. It is synonymous with farming–the production of food, fodder and other industrial materials (Goyal, 2010).

Agriculture enables to meet the basic needs of human and their civilization by providing food, clothing, shelters, medicine and recreation (Goyal, 2010). Hence, agriculture is the most crucial enterprise in the world. It is a productive unit where the free gifts of nature namely land, light, air, temperature and rain water etc., are integrated into single primary unit indispensable for human beings (Dorward & Kydd, 2004). Secondary productive units namely animals including livestock, birds and insects, feed on these primary units and provide concentrated products such as milk, meat, eggs, wool, honey, silk and lac. Agriculture provides food, feed, fiber, fuel, furniture, raw materials and materials for and from factories; provides a free fare and fresh environment, abundant food for driving out famine; favors friendship by eliminating fights (Schultz & T.W., 2007). Satisfactory agricultural production brings peace, prosperity, health, harmony and wealth to individuals of a nation by driving away distrust, discord and anarchy. It helps to elevate the community consisting of different castes and clauses, thus it leads to a better social, cultural, political and economic life (Afoakwah, et al., 2008).

Agricultural growth is multi-directional having galloping speed and rapid spread with respect to time and space. After green revolution, farmers started using improved cultural practices and agricultural inputs in intensive cropping systems with laborer intensive programs to enhance the production potential per unit land, time and input (Aikpokpodion, 2010). It provided suitable environment to all these improved genotype to foster and manifest their yield potential in newer areas and seasons. Agriculture consists of growing plants and rearing animals in order to yield produce and thus it helps to maintain a biological equilibrium in nature (Afoakwah, et al., 2008).

Agricultural sector plays an essential role in the process of economic development of a country. It has already made a significant impact on the economic prosperity of advanced countries and its role in the economic development of less developed countries is of vital importance. In other words, emphasis is being laid on agriculture and other primary industries where per capita real income is low (Asfaw, et al., 2010). "Increase in agricultural production and the rise in the per-capita income

of the rural community, together with the industrialization and urbanization, lead to an increased demand in industrial production"-Dr. Bright Singh. The history of England is clear-cut evidence that Agricultural Revolution preceded the Industrial Revolution there (Arnould, et al., 2009). In U.S.A. and Japan, also agricultural development has helped to a greater extent in the process of their industrialization. Similarly, various under-developed countries of the world engaged in the process of economic development have by now learnt the constraints of putting over-emphasis on industrialization as a means to attain higher per capita real income. "Thus agricultural and industrial developments are not alternatives but are mutually supporting and are complementary with respect to both inputs and outputs." It is seen that increased agricultural output and productivity tend to contribute substantially to a comprehensive economic development of the country; it will be rational and appropriate to place greater emphasis on further development of the agricultural sector (Duguma, et al., 2001). The agriculture sector is the backbone of an economy which provides the basic ingredients to mankind and now raw material for industrialization (Gockowski & Sonwa, 2008).

Agriculture has is the backbone of an economy, for without it a country will always depend on foreign countries to feed its population, the potential contribution of agriculture to economic development has been an on-going subject of much controversy among development economist, several authors argue that growth in the overall economy is dependent on the development of agricultural sector (Gollin & Parente, 2002). The expansion in the agricultural sector could be a catalyst for national output growth via provision of resources for transformation into an industrialized economy and its effect on rural incomes (Piesse, et al., 2003). Agriculture has contributed to the economic growth and development of many economies. The following facts clearly highlight the importance of agriculture in an economy;

Agriculture is the main source of raw materials to major industries such as jute fabric and cotton, tobacco, sugar, edible as well as non-edible oils is agriculture. Moreover, many other industries such as vegetables as well as processing of fruits and rice husking get their raw material mainly from agriculture.

1.1. Importance of Agriculture.

1.1.1 Contributes to national income.

The main source of our national income is agriculture. According to National Income Committee and C.S.O., in 1960-61, 52 per cent of national income was contributed by agriculture and allied occupations. In 1976-77, this sector alone supported 42.2% while in 1981-82, its contribution was to the tune of 41.8%. In 2001-02, it contributed around 32.4% of national income. This was further reduced to 28% in 1999-2000. Contrary to this, the proportion of agriculture in U.K. is only 3.1%, in USA it is 3%, 2.5% in Canada, 6% in Japan, 7.6% in Australia. The mere conclusion of all this is that the more developed a country, the smaller the contribution of agriculture in national output.

1.1.2 Source of foreign Exchange.

Most developing countries of the world are exporters of primary products. These products contribute 60 to 70% of their overall export earnings. Thus, the capacity to import capital goods and machinery for industrial development are crucially dependent on the export earning of the agriculture sector. If exports of agricultural goods fail to improve at a sufficiently high rate, these countries are forced to incur heavy deficit in the balance of payments resulting in a serious foreign exchange problem. However, primary goods face prices reduction in international market and the prospects of increasing export earnings through them are limited. Due to this, large developing countries like India (having possibilities of industrial development) are trying to diversify their production structure and promote the exports of manufactured goods even though this requires the adoption of protective measures in the initial period of planning.

1.1.3 Creation of Infrastructure.

The advancement of agriculture requires roads, market yards, storage, transportation railways, postal services and many others for an infrastructure creating demand for industrial products and the development of commercial sector
Importance in International Trade: the sector that feeds the country's trade is the agricultural sector. Agricultural products like sugar, tea, tobacco, rice, spices etc. constitute the main items of exports of India. If the development process of agriculture is smooth, exports will increase and imports will be reduced considerably.

Thus, it enables to decrease the adverse balance of payments and save our foreign exchange. This amount can be well utilized to import other necessary inputs, raw-material, machinery and other infrastructure which is otherwise useful for the promotion of economic growth of the country.

1.1.4 Improvement in Living Standard.

There is an increase in the income of the farmers due to advancement of agricultural sector. It will improve their living standard by constructing better houses, demanding luxuries of life, television, computer, mobile, motor-cycles and many more. So, development of agricultural sector will cause to improve the standard of living of the population.

Agriculture is vital in Industrial development: Many industries dependent on agriculture, raw material from agriculture is supplied to many industries e.g. Cotton Industries, sugar industries, tobacco industries, Paper Industries, Chilies, turmeric etc. Many industries supply the inputs to the agricultural industry e.g. fertilizers, insecticides, pesticides, implements and machineries like tractors etc.

1.1.5 Great Employment Opportunities.

Drainage system, Construction of irrigation schemes as well as other such activities in the agricultural sector is vital as it provides larger employment opportunities. Agriculture sector establishes more employment opportunities to the labor force that reduce the high rate of unemployment in developing countries caused by the fast growing population.

1.1.6 Balanced Growth Economy.

There exists close inter-dependence between industrial sector and agricultural sector. Agricultural sector will expand the industrial sector also. Income earned by cultivator will increase the demand for the industrial goods. Its results are in balance growth of the economy.

2 Objectives and Methodology.

2.1 Objectives.

The aim of the thesis is to empirically analyze the factors that affect the production of cocoa in the top three cocoa producing countries; Cote D'Ivoire, Ghana and Indonesia. The study specifically seeks;

1. To analyze agricultural commodities on the market.
2. To analyze the factors that affect cocoa production.
3. To analyze the prices of cocoa production.

2.2 Methodology.

The study empirically analyzed the factors that affect production and price of cocoa in the top three leading cocoa producing countries in the world by employing a multiple regression model. Secondary data was used for the purpose to meet the set objectives of the study. Data was collected from the Food and Agricultural Organization (FAO), World Bank (WB), Ghana statistical service (GSS), Ghana Cocoa Board (COCOBOARD), International Cocoa Organization (ICO) and the World Atlas.

Other related literature which were relevant for the study to reach the aim of the study. Reports and other books were also used in the study.

3 Literature Review.

3.1 Origin and History of Cocoa.

The cocoa tree, known scientifically as Theobroma cocoa, L., originated from the Amazon region of Brazil (Livingstone, et al., 2013; Wood, et al., 2008). According to historical accounts, there is no evidence on the exact time when people started eating the fruit of the cocoa tree. In fact, the first account of cocoa in history dated to the Spanish colonization of the Americas. Thus, the 16th

century is considered the epoch during which the European first discovered cocoa, which had been eaten by Aztecs and Mayan prior to contact with Europeans (Wood, et al., 2008). However, cocoa was produced generally by the Mayan. Many other ingredients, such as chili and vanilla (Gollin & Parente, 2002) and maize (Duguma, et al., 2001) have been used together with cocoa. Despite the fact that the cocoa bean is the most interesting part of cocoa today, the first cocoa tasters used to eat only the cocoa pulp. In effect, the bean was eaten for the first time by unknown Aztecs, who took that risk after roasting the tropical fruit (Duguma, et al., 2001). In addition to the energetic properties of cocoa, earlier cocoa tasters used cocoa for such purposes as medicine, divinity and as currency (Wood, et al., 2008). Indeed, it was known as the "food of the gods" in the Aztec civilization (Gianfagna & Cooper, 2012). Moreover, chocolate was the main drink of Montezuma, the Aztecs emperor in Mexico in the earlier 1500s according to (Gockowski & Sonwa, 2008).

Cocoa beans were one of the Aztecs currencies too (Duguma, et al., 2001). Christopher Columbus is the one who first introduced the cocoa beverage to Europe (Gianfagna & Cooper, 2012). Domesticated in the Amazon forest, the cocoa tree has been propagated in South and Central America, and in almost all tropical countries in Africa and Asia. Wood, et al., (2008), revealed that cocoa was disseminated in South America and the Caribbean in the 17th century, which is when it was likely, brought to Haiti. He continued to explain that during that same period cocoa reached Asia and was grown there too. The Philippines was the first country in Asia where cocoa was grown. Until the 18th century, people were interested only in the Criollo variety of cocoa bean. The domestication of Forastero, an improved variety of cocoa, occurred in 18th century in Ecuador and Brazil. After that, cocoa production spread to West Africa in the second half of the 19th centuries. Ghana and Nigeria were the first places in Africa where cocoa were introduced (Wood, et al., 2008).

Table 1: Some facts about Cocoa.

Production	
Planted area	6.5 million hectares (FAO 1998)
Production	2.7 million tons beans
	70 % from Africa
Average yield	400 kg beans/ha/year (US$ 370 – 09/2000)
95 % produced on smallholdings under 4 hectares	

3.2 Importance of cocoa beans.

The seeds found in cocoa pods are called cocoa beans, which grow on trees often found in Africa, and Central and South America. These beans are fermented, dried, crushed, processed and manufactured into chocolate and other cocoa products. Many different sorts of products can be derived from cocoa. The husks of cocoa pods and the pulp, or sweetings, surrounding the beans and the cocoa bean shells can be used.

3.2.1 Uses of Cocoa Beans.

3.2.1.1 Cocoa Powder.

Cocoa powder goes through a process of drying the roasted and fermented cocoa beans, separating the butter from the solids and then ground into a fine powder which is used in a number of foods. Baking chocolate desserts and chocolate cakes almost always call for a good quality cocoa. Also, many hot chocolate fans prefer the taste of cocoa to store-bought hot chocolate.

3.2.1.2 Cocoa butter.

Chocolate manufacturers use cocoa butter in the production. Cocoa butter is also widely used in cosmetic products such as moisturizing creams and soaps.

3.2.1.3 Cocoa Liquor.

This is the first commercial product extracted in the processing of cocoa beans but contrary to its name, does not contain any alcohol. Cocoa liquor is used to produce chocolate together with other ingredients. Chocolate is used as a product on its own or combined with other ingredients to form confectionery products.

3.2.1.4 Cocoa Cake.

Cocoa liquor destined for processing into cocoa butter and cakes are refined to very small particle sizes, while for chocolate manufacturing it does not need to be as finely ground. The liquor is put into hydraulic presses that remove a percentage of the cocoa butter, leaving behind a cake.

3.2.1.5 Cocoa pod husk ash.

The cocoa husk is usually dried in the open over a few weeks and then burned to produce the ash which then becomes an ingredient in soap making. Many natural beauty advocates will use this ash in their soap and cocoa butter in their moisturizing creams.

3.3 Cocoa Production.

Cocoa trees are normally grown in tropical environments, within 15 to 20 degrees latitude from the equator. The ideal climate for growing cocoa is hot, rainy, and tropical, with lush vegetation to provide shade for the cocoa trees. The main growing regions are Africa, Asia, and Latin America. The largest producing country by volume is Côte d'Ivoire, which produces about 33 percent of overall global supply Major producing countries in each region include:
• Africa Côte d'Ivoire, Ghana, Nigeria, Cameroon
• Asia/Oceania Indonesia, Malaysia, Papua New Guinea
• Americas Brazil, Ecuador, Colombia

World Cocoa production by Region
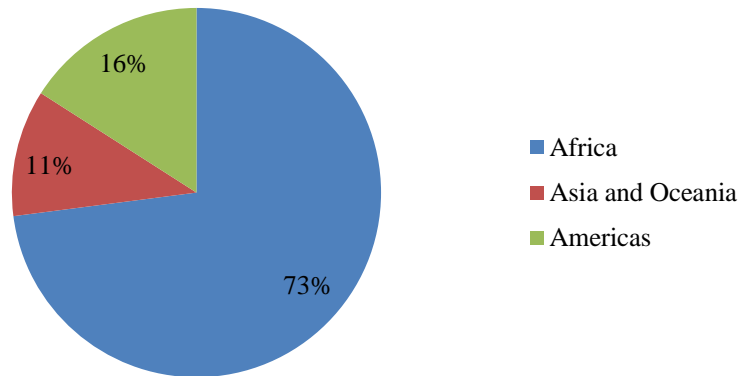
Figure 1: World Cocoa production by Region.
Source: World Bank, 2010.

Unlike large, industrialized crops, about 80% to 90% of cocoa are cultivated from small, family-run farms, with approximately five to six million cocoa farmers worldwide. In Africa and Asia, the typical farm covers two (2) to four (4) hectares (five to ten (10) acres). Each hectare produces 300 to 400 kilograms of cocoa beans in Africa and about 500 kilograms in Asia. Cocoa farms in the Americas tend to be slightly larger and cultivate about 500 to 600 kilograms of cocoa beans per hectare. Yield per hectare varies not only by region, but also by country and by type of cocoa.

Cacao (Theobroma cacao L.) is a tree crop which is most suitable or compatible under different production systems (intercropping, mono-cropping and agroforestry.) It is grown mainly for each bean, processed into cacao powder, cake and cacao butter. Largely used in the manufacture of chocolates, soaps, cosmetics, shampoo and other pharmaceutical products.

3.3.1 Major Varieties of Cocoa.

3.3.1.1 Criollo.

This variety has superior quality and is relatively susceptible to pest and diseases. Criollo trees are not as hardy, and they produce softer pods, containing 20-30 ivory or very pale purple beans. Criollo cacao typically has red or yellow pods, some being green or white. The pods have a bumpy or warty skin with pointed tips. The beans, on the other hand, vary from light purple to white in color, and they are plump and full. In general, the beans from Criollo cocoa are considered to have a finer flavor than of other cocoa varieties. Criollo trees are not very disease-resistant and, hence, are hard

for farmers to grow and keep them healthy. Typically, when chocolate is made from Criollo beans, the chocolate is not overly rich, though the resulting chocolate will have a composite flavor that is often reminiscent of various fruits and spices. Criollo beans are therefore considered to be "flavor beans". Venezuelan Criollo cocoa is found throughout the entire Central American region, including Mexico. It is most notably present in the states of Tabasco and Oaxaca. Even so, these regions still have their own "native" (or Criollo) varieties.

3.3.1.2 Forastero.

This is a high-yield variety with round pod and thick-walled which turn yellow when ripe and has a flat, violet seed: one group of Forastero is Amellonado which is more genetically uniform. This group now forms the greater part of all cacaos grown. It is a hardy and vigorous tree, producing beans with a strong flavor. Amellonado, with a smooth yellow pod and with more pale to deep purple beans, is the Forastero variety most widely grown in West Africa and Brazil. Today, Forastero mainly refers to cocoa that has its ancestry from the upper Amazon basin. Through trade, this cocoa has been spread throughout much of the cacao-growing world, including Africa. Today, the largest producers of these cacao beans are Ivory Coast and Ghana, where Forastero was inaugurated very early in the cocoa trade. Because of this and the disease resistance of this variety, the top producing countries grow primarily Forastero.

Most of the chocolate produced in the world today is made from Forastero beans. The hull of the Forastero pod, rather than being deeply furrowed with a knobby skin and pointed pod, as the Criollo pods are, is fairly smooth, with more of a bulbous pod shape. In addition, the hull is also woodier than the Criollo, and thus the pods are harder to open. The pods may also be red or yellow, as well as purple or orange. The beans themselves are very dark purple and are fairly flat compared to those of the Criollo. The Forastero does not have the complex flavor of the Criollo, nor does it have the spicy and fruity notes that one may find in the Criollo. Instead, the Forastero has a much richer "chocolate" flavor. Hence, Forastero beans are usually considered "bulk beans," while Criollo beans are considered "flavor beans." Chocolate makers will typically use primarily the Forastero for their chocolate blends to create a rich, chocolate flavor background, and then add a variety of flavor beans to make the final chocolate more complex and tasty. While cocoa from Ecuador is fine in flavor, it is generally considered to be a Forastero by popular classification. The flavor is much the same as that of other Forasteros, with the addition of fruity overtones not present in other Forasteros.

This type of cocoa is native to Ecuador, and thus it is a Criollo (native) as regards to Ecuador. As may be imagined, this could have caused plenty of confusion except that the native cocoa variety has been named National, thus preventing further confusion of the Criollo name than already exists.

3.3.1.3 Trinitario.

This variety of cocoa is a hybrid between Criollo and Amellonado. This is a cultivated hybrid of the other two types. Trinitario cacao trees are grown mainly in Colombia and Central America, but also in Cameroon and Papua New Guinea. The hard pods contain 30 or more beans of variable color; white beans are rare. As the name implies, Trinitario originates from the island nation of Trinidad. Today, Trinitario together with Criollo provides the basis for "flavor beans," used to enhance the flavor of today's chocolate. Trinitario pods are typically not pointed, and their skin is relatively smooth, compared to Criollo pods; beans are flat and purple when cut in half. Trinitario, like Forastero, has spread throughout the world as a major cacao crop.

Table 2: World Cocoa Production (000 tons)

Country	2011/12	2012/13	2013/14
Cote D'Ivoire	1486	1449	1741
Ghana	879	835	897
Indonesia	440	410	405
Nigeria	245	238	250
Brazil	220	185	228
Cameroon	207	225	210
Ecuador	198	192	210
Papua New Guinea	39	41	42
Others	382	371	382
Total	4096	3946	4365

Source: Food and Agriculture Organization (2016).

3.4 Cocoa Production in Ghana

In Ghana, cocoa has played a vital role in the economy of the country for over one century. Although the crop was believed to have been brought to the colonial Gold Coast - as Ghana formally known as - from Fernando Po, an island in the Gulf of Guinea, off the coast of Gabon, in 1879 and from Sao Tome in 1886, records show that in 1891, only twelve years after its first arrival here, cocoa was being transported as a cash crop (Adjinah & Opoku, 2010). From the 1910/1911 season, Ghana became the leading cocoa producer in the world, a position it held until 1977, when Ivory Coast took over. The country went from being the number one cocoa producer to a period in the early 80s when, as a result of drought, bushfires, low producer prices and general economic malaise, Ghana fell to the twelfth position and produced less than 160,000 metric tons in the 1983/1984 season (Adjinah and Opoku, 2010). Cocoa as a cash crop became attractive in Ghana because of the lower cost involved in its cultivation, compared to a popular crop like palm, as well as the favorable natural conditions that existed in the forest belts. Cocoa could be grown along with other crops and when soil conditions deteriorated the land could be left to the cocoa trees and other tracts tilled in the shifting cultivation systems of farming (Acquaah, 1999). Because of the prominence that the crop had begun to gain in the economy, even before World War II, government was seriously alarmed when the swollen shoot disease was detected in 1936. In the process of fighting this disease, a permanent research center was established at Tafo, in the Eastern Region, and product quality inspectorate, extension services, grading of beans and proper engagement of farmers in the growth of the crop were initiated (Acquaah, 1999). Since then government has continuously offered technical assistance, financial incentives and inputs like fertilizer and pesticides to cocoa farmers. As a result of government intervention over the last decade, cocoa production has picked up, reaching a peak of 740 thousand metric tons in the 2005/2006 season (Aryeetey, 2007). Constituting 7.3% of the Gross Domestic Product of the country, it is second only to gold, which initially overtook cocoa as the highest foreign exchange earner in 1992; a trend which still continues. Agriculture contributes about 35% of Ghana's Gross Domestic Product (GDP) and 60percent of total overall employment. The Cocoa Industry is the single largest contributor to agricultural GDP (25%). It is estimated that about 65% of the country's agricultural labor force work either directly or indirectly in the cocoa industry. In Ghana cocoa is grown on small farms owned by individuals and families in the forest zones of Brong Ahafo, Ashanti, Eastern, Western, and Volta regions. Thus the livelihood of about two million farmers and their dependents, mostly in the rural areas, depend directly on cocoa (Opoku, et al., 2006).

In Ghana, cocoa is the primary cash crop providing about one-third of all export revenue. With higher commodity prices, gold and cocoa were the two top export revenue earning sectors for Ghana where GDP was estimated at $38.24 billion in 2010. Cocoa remains the mainstay of Ghana's economy accounting for 40% of agricultural exports and 12 % of country's GDP. In 2007 for instance, cocoa contributed 35% of Ghana's GDP and 60 % of employment in agriculture (Centre for the Studies of African Economies (CSAE), 2009). In spite of commencement of oil production in Ghana, agriculture, usually the cocoa sector would remain the key to rural transformation of the economy.

3.4.1 Factors that affects Cocoa Production in Ghana.

3.4.1.1 Challenges associated to the distribution and use of farm inputs.

Distributions of quality farm inputs are very important to ensure high cocoa production in the cocoa industry. There are however a lot of challenges related to the distribution and the usage of these inputs. 932 tractors were imported in 2008 by the Ministry of Food and Agriculture to enhance productivity of the sector but as a result of poor monitoring of the distribution, it was found out that the beneficiaries ended up being some government officials who were not farmers.

Likewise, in 2014, the government established a scheme to issue free fertilizers to farmers; however the purpose of the scheme could not be achieved as a result of corrupt practices that transpired in the distribution chain. The Amanfi farmers for example blamed COCOBOD's officials for a massive corruption in the distribution of these fertilizers as farmers were rather to pay for them by force whilst others had to show political party cards in order to benefit (Mark & F., 2015).There is also a risk of use of farm inputs such as fertilizers and pesticides as a result of the fact that many of the cocoa farmers in Ghana have little or no education. Looking at the number of cocoa farmers in the country, the numbers of agricultural extension officers are woefully insufficient. Farmers are sometimes asked to be in groups so that they can receive training together at a predetermined venue. For lack of funds and will to travel for training, some farmers resort to their own initiatives which end up applying the wrong proportions of fertilizers, use pesticides at wrong times and even combine various pesticides which give different reactions and rather have negative effects on productivity.

3.4.1.2 Commercial risks associated to cocoa supply chain.

3.4.1.2.1 Volatility of Cocoa Price.

One main challenge associated with cocoa production in Ghana is the cocoa price volatility. This short-term challenge is borne entirely by COCOBOD as it transfers the challenge of freely floating international cocoa prices into the assured price it provides to the farmers. In guaranteeing a fixed price, Cocobod efficaciously absorbs price challenge within the season from the farmers, as the international market is subject to freely floating prices. Cocobod therefore has to carry a significant cash flow obligation to pay the farmer for their farm produce at the time of harvest while it only receives revenues post-shipment. When international prices rise, the margin between the prices COCOBOD pays to the farmer and its international market sales price increases. This is reversed when the international prices fall, as the margin between the prices paid to the farmer and the sales price decreases. As stated by the World Bank Report in 2011, during crisis years, the margin sometimes even turns negative. International prices of cocoa rose steadily throughout the 2013/14 season, gaining 24% to reach US$ 3,313/MT at the end of September, 2014, however, by October 29th in the same year, the price dropped to US$3,000/MT. According to Kwanashie et. al.,(1998), the degree of change in prices is a major concern to the cocoa industry and either Cocobod, LBCs or farmers end up being cheated (Kwanashie, et al., 1998).

3.4.1.2.2 Lack of Adequate Credit Facilities.

An inadequate credit facility for cocoa farmers is another big challenge in the cocoa industry. Small-scale cocoa farmers especially have a tough time in acquiring farm inputs for their farms. Some farmers who seek financial assistance from some purchasing clerks sometimes feel cheated as they try to dictate unfriendly terms and conditions to these farmers. This results in a very little profit being earned at the end of the day and this de-motivates other cocoa farmers to expand the size of their farms for lack of funds (Laven, 2010).

3.4.1.2.3 Low Buyer Margins.

The Ghana Cocoa Farmers Survey data between 2001/ 2002 and 2003/2004 disclosed that six LBCs operating in 2001/2002 had gone out of business by 2003/2004 (David, 2012). Zeitlin (2006) establishes that the bankruptcy rate among LBCs is so high meaning that margins paid by government to cocoa delivered by the LBCs to Cocobod is woefully unsatisfactory (Zeitlin, 2006).

3.4.1.2.4 Excessive Power of Cocobod.

Some Licensed Buying Companies (LBCs) complain that Cocobod exerts excessive power over them which sometimes affect their efficiency. Policies from Quality Control Division (QCD) and Cocoa Marketing Company (CMC) are pushed on them with little or no consultation. Cocobod defines the quantum of seed it requires from a Licensed Buying Company (LBC) in order to maintain its license. With little or no flexibility, some Licensed Buying Companies (LBCs) feel quite overstretched.

3.4.1.2.5 High Cost of Financing.

The cost of borrowing in Ghana is very expensive. The interest rate stands at 22% (BOG, August 2015). This coupled with the time it takes to get funds locked up in stock of cocoa released to Cocobod makes it very tough to do business as an LBC in Ghana. This amounts to the collapse of some Licensed Buying Companies (LBCs).

3.4.1.3 Production Challenges Associated To Cocoa Production in Ghana.

3.4.1.3.1 Aged Cocoa Trees and the Aged workforce.

The cocoa yields in Ghana are relatively low in recent times partly because of the old age of farmers, their farms and the cocoa trees (Laven, 2010). The productivity of cocoa trees generally declined after a period of about 20 years; what aggravates the problem is that cocoa production is also labor intensive. Farmers perceive that the cost of eradicating old plants and replanting new ones is so high as compared to the cost of maintaining old trees; coupled with the old age and lack of enough strength by most farmers, they decline to do replanting (Laven, 2010).

3.4.1.3.2 Unsatisfactory Land Tenure Policies in Ghana.

The land tenure policy has also been an important obstacle to the expansion of cocoa farms in Ghana. The chiefs in a traditional area own vast portion of the lands and most of the farmers are immigrants and sharecropping farmers. The policies around the possession and use of the land in most cases are unfair to the ordinary farmer who travail so much to realize the yield. Policies such as: 'abunu', 'abusa' or 'abunan' systems which represent a ratio of 1:2, 1:3, 1:4 respectively representing the ratio of share of produce between land owner and farmer (s) respectively de-motivate the farmer who most times feel cheated looking at their level of investment into the production (Basso, et al., 2012).

3.4.1.3.3 Pests and Diseases.

Cocoa plantations are susceptible to many kinds of diseases, which are said to destroy from 30-40% of the world cocoa production every year (Basso, et al., 2012). Pests and diseases constitute one of the greatest challenges in the production of cocoa in Ghana. However, farmers may find it more economical to expand than replant old and diseased trees, because it takes twice as long just to clear an old farm than to clear new forest lands (Kolavalli & Marcella, 2011).

Many Licensed Buying Companies (LBCs) are unable to provide adequate storage facilities for farmers and even at the port, difficulties in storage often times becomes very difficult and causes to traffic congestion at the port (David, 2012). Access to tractors to easily convey cocoa beans for drying on sheds pose serious challenges to many farmers. What aggravate the situation are the deplorable roads leading to farming communities; some communities have broken bridges and very poor access routes to their farms. These farmers are most times left with no choice than to resort to child labor to carry the seeds from the farms in small quantities. The situation becomes unbearable especially in the raining season when a lot of seeds are destroyed for lack of these facilities.

3.4.1.3.4 Logistics- related Challenges.

Many Licensed Buying Companies (LBCs) are unable to provide adequate storage facilities for farmers and even at the port, difficulties in storage often times becomes very difficult and causes to traffic congestion at the port (Gyamerah, 2007). Access to tractors to easily convey cocoa beans for drying on sheds pose serious challenges to many farmers. What aggravate the situation are the deplorable roads leading to farming communities; some communities have broken bridges and very poor access routes to their farms. These farmers are most times left with no choice than to resort to child labor to carry the seeds from the farms in small quantities. The situation becomes unbearable especially in the raining season when a lot of seeds are destroyed for lack of these facilities.

3.5 Cocoa Production in Indonesia.

Indonesia is the third largest cocoa producing country in the world after Côte d'Ivoire and Ghana, but its significance as an exporter is declining due to rising domestic demand. Responding to Indonesians' increasing taste for chocolate and other goods made from cocoa, global companies have invested heavily in cocoa grinding facilities and downstream businesses in last few years. Farmers, however, are battling to increase cocoa bean output and have become the weak link in Indonesia's cocoa industry. As a result, cocoa processors are coerced to source a growing portion of their raw beans from abroad at a time of high global prices. Cocoa growing can have a bright

future in Indonesia, but creating the necessary economies of scale to boost productivity involves lots of investment to implement modern farming methods and technology. Once that is achieved, Indonesia will be well positioned to capitalize on growing cocoa and chocolate consumption at home and in the wider region (Natawidjaja, 2009).

3.5.1 Area and Production.

The Indonesian cocoa sector has encountered tremendous growth in the past 25 years, driven by rapid expansion of smallholder farmer's participation. Indonesian smallholders contribute-by far, most of its national production, thus outperforming big state plantations and large private estates. The country currently has approximately 1.5 million hectares of cocoa plantations. Currently, smallholders contributed 87 % of national production, versus 8 % from state plantation and only 5 % from large private estates. Some of the smallholder's cocoa was initially bred in Malaysia and was developed purposely for high yield but not on its flavor. Edel (fine flavored cocoa) cocoa is planted by state or large private plantation. The table below shows comparison of total acreage from 1995 to 2003 base on the three type of cocoa holding (Wahyudi & Drajat, 2013).

The major producing area of cocoa is Sulawesi Island and the remaining Indonesian cocoa production takes place in North Sumatra, West Java, and Papua, with some small production areas in Bali, Flores, and other islands. To increase the production, effort has been made by an extensive mono-crop production of cocoa expanded in parts of Sulawesi where suitable land was abundant and accessible. However, as available land decrease and the age of bearing trees increases, more intensive production techniques will be required to maintain and/or expand cocoa farm productivity.

Table 3: Total acreage of cocoa plantation by type of holding 1995- 2003 (Ha)

Type of Holding	1999	2000	2001	2002	2003
Smallholders (ha)	534,670	641,133	710,044	798,628	801,332
State Own (ha)	59,990	52,291	55,291	54,815	54,815
Private (ha)	73,055	56,094	56,114	60,608	61,487

Source: Directorate General of Estate Crop, Min. of Agriculture.

3.5.1 Challenges Facing the Cocoa Production in Indonesia.

Cocoa, both on farm and off farm of Indonesia, is facing four main threats.

3.5.1.1 Aging Trees.

A serious problem facing cocoa sustainability is aging trees. This applies not only to Indonesian cocoa but to all cocoa producers around the world. According to Natawidjaja (2009), the average age of cocoa trees is about 20 years. By 2013 the average cocoa plantation was about 25 years old. Because of this, although many efforts have been made to increase cocoa pods, such as fertilizers, and to control cocoa pests and diseases, farmers are still left with low production compared to previous years. Therefore, cocoa revitalization has been put forward to renew cocoa plantations (Natawidjaja, 2009).

3.5.1.2 Poor Skill and Knowledge Levels among Farmers.

Between 2000 and 2011, the number of Indonesian cocoa farmers increased by over 50%, from about 170,000 smallholders to nearly 400,000 smallholders (Wahyudi & Drajat, 2013). Similarly, as Natwidjaja (2009) states, the number of people, including farmers themselves, who rely on this sector was nearly 1.5 million people and it is expected to increase in the near future. Over 1.3 million ha of cocoa-producing land is owned by smallholders while other private sector entities manage only 2 percent of the total and the government has 4 percent. From this it can be calculated that every farmer can manage more or less one hectare of cocoa plantation. However, in fact, production has tended to fall from year to year. In this case, lack of skill and knowledge of good agriculture practices has become a serious problem. For instance, to manage cocoa pests and diseases, farmers have relied on synthetic pesticides and thus they were vulnerable to exposure to chemical contaminants. Another problem is a lack of consistency in cocoa farm management (Natawidjaja, 2009).

Poor sanitation and inappropriate fertilizers were often seen in many cocoa areas. The vulnerability to pests and disease infestation is mostly caused by poor tree and farm sanitation as well as inappropriate soil fertilizers. A further crucial issue related to farmers' knowledge is poor harvest-handling management such as treatment for bean fermentation. It is believed that fermenting the beans immediately after harvesting the fruits from the trees will significantly increase the quality of the cocoa beans. It is undeniable that there is a strong positive correlation between fully fermented

cocoa beans and maintaining the quality of the beans. However, many cocoa growers still have not fully embraced fermentation (Dorward & Kydd, 2004).

3.5.1.3 Cocoa Pests and Disease Infestation.

The invasion of cocoa pests and diseases is one of the most serious problems on cocoa farms As Lass (1999) states, total losses of cocoa production due to pests and diseases were substantial. Similarly, Cramer (1967), cited in Lass (1999), argues that the potential loss from disease can reach 39 percent of the total annual cocoa production, or about 588,000 mt out of a total of 1,528,000 mt of world cocoa production by 2008 (Lass, 1999).

One of the main cocoa diseases is vascular streak dieback (vsd). It has been estimated that vsd can cause losses of about 30 mt where it occurs, and Indonesia is badly affected. (Guest & P., 2007)) point out that v sd caused heavy losses of mature trees and seedlings in Sulawesi. Vs d is caused by Basidiomycete Oncobasidium theobromae, also known as Thanatephorus theobromae and found the pathogen of vsd, T. theobromae, in Luwu regency (Wahyudi & Drajat, 2013). The vsd fungus has characteristics and symptoms that can be identified properly in the field. In particular cases of vsd, the tree can be devastated and the pathogen can be difficult to eradicate with chemical usage. The fungus exists within the xylem vessel and in a short time can destroy the host when there is high humidity and low temperature. However, while black pod disease can damage cocoa production due to pod mummification and reduce the quality of beans due to enzyme and mycotoxin activities within the pod layers, it does not very often kill the trees themselves. This disease is predicted to be more dangerous than other cocoa diseases. Samuels, et al. (2012), argue that vsd has a severe long-term effect (Samuels, et al., 2013). The disease can potentially kill all growth stages of cocoa on the plantation, from seedlings to branches to even entire trees, not just destroy a year's crop (Purwantara, et al., 2009).

Another cocoa pest, cocoa pod borer, is one of the major constraints to production not only in Indonesia but also in all countries producing cocoa in South and Southeast Asia and Melanesia. The cocoa pod borer is caused by the insect Conopomorpha cramerella (Snellen). Damage to beans or pods is a characteristic destruction of this pest. Cocoa pod borer occurred for the first time in Indonesia many years ago. At that time there was not much information about the life cycle, pod symptoms, natural enemies and alternative hosts, nor were there extension specialists and local farmers with skill and knowledge. Nowadays, although these pests still exist in the cocoa ecosystem,

the lost production due to their infestation is not significant. Outbreaks and the number of affected trees can be controlled by various techniques.

Another disease is pod rot phytophthora or black pod disease, which can lead to heavy losses (Natawidjaja, 2009). It is caused by several species of phytophthora (Junaid, 2015). Overall, most areas in Sulawesi are infected with vsd and black pod disease as well as other main cocoa pests (Bowers, et al., 2001).

3.5.1.4 Poor Soil Nutrients and Postharvest Handling.

A main problem of growing plantation cocoa is that the soil quality tends to deteriorate over time. Many farmers just harvest cocoa pods without making a serious effort to maintain the quality of their soil. As Sari & Baon (2013) argue, because the soil fertility has decreased, cocoa productivity has also fallen over the last decade (Sari & Baon, 2013). Cocoa plantations require macro- and micronutrients. A further issue related to postharvest handling is the poor quality of the cocoa beans. It is commonly believed that the lack of bean treatment after the fruits have been harvested from the trees is a key problem. Marseno (n.d) points out that a serious issue of bean quality in Indonesia is tied to poor postharvest handling (Zakiya & Pramesti, 2012).

Consequently, poor fermentation treatment of beans can seriously deplete chocolate flavor when producing chocolate products. According to cocoa practitioners, the cocoa farmers seem to be reluctant to practice bean fermentation because they do not get an incentive price from the buyer. Non-fermented and fermented pods are not significantly different in price, but treating the pods requires farmers to spend a great deal of time, cost and attention on their pods. Another reason is that they do not see the difference in quality between non-fermented and fermented treatments (Sari & Baon, 2013).

3.6 Cocoa Production in Cote D'Ivoire.

The economy of Côte d'Ivoire is dominated by agriculture, in particular the growing of cocoa beans, the country's largest export. Cocoa seeds were first brought into Côte d'Ivoire from neighboring Ghana. Cultivation gradually spread westwards right across the country to the border with Liberia. By far the leading producer, in 1998 the Côte d'Ivoire produced 41% (1.1 million tons) of the world's cocoa beans. Most of these are grown on small farms on cleared land that was once extensive rainforest in the south of the country. There are an estimated 1 - 2 million cocoa farmers, many of whom have relocated to the Côte d'Ivoire from Mali and Burkina Faso. Cote d'Ivoire is the world's

leading producer of cocoa, supplying 46% of the world's cocoa production in 2006. The production of cocoa is crucial to Ivory Coast's national economy.

Côte d'Ivoire supplies more than a third of the world's cocoa and its exports for the global chocolate market were worth around 2.5 billion dollars in 2010 (according to the UN's Food & Agriculture Organization). However, revenues from cocoa production are threatened by regular blights such as black pod disease. Small farmers are unable to afford the regular spraying which would preserve their cocoa crops. The industry also suffers from under-investment. Local investment is hampered by high taxes on farmers, with around 40% of the money paid by commodity buyers going to the government. Because most cocoa producers are small-scale, this has led some farmers to rely on child labor to make a living.

3.6.1 Challenges of Ivorian cocoa economy.

Côte d'Ivoire, a West African country with 16,000,000 inhabitants, is the world's largest producer of cocoa beans, with an average annual production of 1,200,000 tons, representing 41% of the supply World. On the national macroeconomic level, the level of production achieved means that the cocoa economy provides about 40% of export earnings and contributes 10% to the formation of the Gross Domestic Product (GDP). On the social level, there are about 600,000 chiefs of exploitation who animate the production apparatus, thus making live about 6,000,000 people of cocoa income.

We can then say on the one hand that Côte d'Ivoire occupies a prominent place on the international cocoa market and on the other hand that cocoa farming is of crucial importance to its economy. The combination of these two facts makes the country particularly sensitive to the analysis and proper management of the strategic issues inherent in the sustainability of cocoa production, especially in the context of an increasingly liberalized global economy.

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3.6.1.1 Quality is a major challenge for medium-term marketing.

Among the issues facing the Ivorian cocoa economy successfully is the importance of rational quality management. This issue is divided into two parts, one technical and operational, and the other ethical.

3.6.1.2 Technical and operational aspects.

On the technical and operational level, it is a matter of attesting, in the light of the relevant standards, that Ivorian cocoa (or the chocolate that is made of it) possesses the necessary technical and physico-chemical characteristics. Beyond strict adherence to the usual export standards (moisture content, rate of different types of defective beans, foreign matter content, acidity rate, particle size, etc.), this is all the problem related to the introduction of vegetable fats other than cocoa butter into chocolate, but also and above all the problem of controlling the level of contamination of the beans by ochratoxin A (OTA). In this respect, the entry into force of the European directives, without Côte d'Ivoire being able to promote the purity of its cocoa and to test its conformity, is fraught with threats, in view of the significant weight of The European Union at the level of cocoa exports.

3.6.1.3 Ethical aspects: social responsibility in cocoa production.

From an ethical point of view, particularly with regard to social responsibility, it is a matter of attesting to the efforts made to ensure that the production of Ivorian cocoa meets the standards laid down in this respect. In this particular case it should be pointed out that the threat is related to the adequate treatment of the issue of child labor in cocoa plantations.

Indeed, given the media attacks from the US by pressure groups and non - governmental organizations, directed at the chocolate industry and producing countries, including Côte d'Ivoire in particular, A stay for American manufacturers regarding the "product without recourse to the worst forms of child labor" on chocolates and cocoa products sold on the American market. On the other hand, on September 19, 2001, the chocolate industry signed a protocol, known as the Harkin-Engel protocol, named after the American legislators. These legislators, along with Côte d'Ivoire,

the International Labor Organization (ILO) and lobby groups, have also signed the protocol as witnesses

The protocol required parties, primarily industry, to take action to design and implement by 1 July 2005 a credible and mutually acceptable system to certify that cocoa production does not use "the worst Forms of child labor ", in accordance with the provisions of ILO Conventions Nos. 138 and 182 . In addition to the protocol, the US administration has also implemented a regular reporting process to evaluate the efforts undertaken by States in relation to the problem raised.

In particular, two public requests by the US government have highlighted this problem of child labor, one of which (Federal Register of 10 May 2004 on information to be provided on the worst forms of child labor in cocoa farming in Côte d Ivory, initiated by the US Department of Labor, USDOL, and the other, (US Federal Trade Commission's US Federal Trade Register of August 26, 2004) to examine the eligibility of African These two requests were to enable the US administration to make decisions at the end of 2004 in relation to:

•   The advisability of banning the import of cocoa origin Côte d'Ivoire;

•   The eligibility of Côte d'Ivoire to AGOA for the year 2005.

In addition to the attention given to the US market, we must also take into account the expectations of the European market, which absorbs almost two-thirds (2/3) of cocoa exports. Indeed, since July 2005 the European Parliament has initiated a process to include a clause relating to the adequate treatment of the issue of child labor in trade agreements and strategic partnerships with the ACP countries.

In short, access to almost the entire export market for cocoa from Côte d'Ivoire is conditioned by the adequate treatment of the issue of child labor.

3.6.1.4 Management of issues presented.

The crucial importance of the challenge for Côte d'Ivoire stems from the fact that it is the main source of raw materials for chocolate manufacturers. That is why the Ivorian government is strongly committed to providing a multifaceted and sustainable response to the issue of child labor in cocoa farming. In addition to institutional, legal and criminal responses, operational responses from the implementation of field actions, including prevention, remediation and the integrated approach,

must be mentioned. Thus, under integrated action, social responsibility in cocoa is the focus of the SSTE pilot project, designed and implemented in the department of Oumé from 2005 to 2006.

3.7 Cocoa Contracts.

The Cocoa contract is the world yardstick for the global cocoa market. The contract prices the physical delivery of exchange-grade product from a variety of African, Asian and Central and South American origins to any of five US delivery ports. Like every commodity contract, cocoa has its own ticker symbol, contract value and margin requirements. To successfully trade a commodity, you must be aware of these major components and understand how to use them to calculate your potential profits and loss. For instance, if you buy or sell a cocoa futures contract, you will see a ticker tape handle that looks like this: CC8K @ 1363.

This is just the same as saying "Cocoa (CC) 2008 (8) May (K) at $1,363 per metric ton (1363)." A trader buys or sells a cocoa contract according to this type of quotation. Depending on the quoted price, the worth of a commodities contract is based on the current price of the market multiplied by the actual value of the contract itself. In this instance, the cocoa contract amounts to the equivalent of 10 metric tons multiplied by our hypothetical price of $1,363, as in: $1,363 x 10 metric tons = $13,630

Commodities are traded based on margin, and the margin adjusted based on market volatility and the current face value of the contract. For example, to trade a cocoa contract on the Intercontinental Exchange (ICE), a trader may be obliged to maintain a margin of $2,660, which is approximately 19.5% of the face value.

3.8 Calculating a Change in Price.

Most often commodity contracts are customized, this makes every price movement has its own prominent value. In a cocoa contract, a $1 move is equal to $10. To determine ICE's cocoa profit and loss figures, you compute the difference between the contract price and the exit price, and then multiply the result by $10. For example, if prices move from $1,363 to $1,400, you multiply the difference, which is $37, by $10 to yield a contract value change of $370.

3.9 International Trade and Prices of Cocoa.

The major buyers of West African cocoas are in Western Europe, with the United States being a major buyer of South American and Asian cocoas. Cocoa is usually purchased from origin by international dealers (or traders) who subsequently sell it to final users (usually chocolate

companies) as beans, or process it in their own plants and sell it to the final users as products (liquor, butter or powder). Chocolate companies and cocoa processors prefer to purchase through dealers because they bring the cocoa to a port close to the buyer. They often pass it through customs and the buyer can inspect the shipment and, if necessary, be compensated for any quality shortfall via arbitration, allowed for in the contracts. The prices at any time will be determined by the cocoa futures (or terminal) markets in London International Finance Futures Exchange (LIFFE) and New York (Coffee Sugar and Cocoa Exchange (CSCE) in response to the relative supply and demand balance at any given time (Lass, 1999). Average international cocoa prices, as measured by the ICCO daily price, increased in 2006/2007 from the previous cocoa year by 19% to US$1,854 per ton. The large production deficit in the 2006/2007 cocoa season had been the main factor leading to this development in the market. Other buoyant factors included the position in the futures markets of cocoa processors and chocolate manufacturers, having below-average forward fixed price coverage, and the weakening US dollar against other significant currencies. The highest price level of the season was reached on 6 July 2007, when prices climbed to £1,140 on the London terminal market and US$2,144 in New York, which is their highest level since 2003. However, the strong increase in recorded prices induced some nervousness among market participants and, at such relatively high prices, the markets were rendered unsafe to profit taking in the second week of July, the cocoa futures markets witnessed a strong adjustment and, after a short-lived recovery, the markets again retreated until the fourth week of August.

The decline in prices was not attributed to particular bearish news on the fundamental cocoa supply and demand situation, but may have been related to concerns in financial markets over the US subprime mortgage market crisis. This may have prompted funds to reduce their investments in cocoa to cover stock market losses. However, the US subprime mortgage market crisis is likely to have acted only as a catalyst, hastening and exacerbating an expected downward correction at that time of the year in the cocoa market. Indeed, future cocoa prices had soared by more than 30% in London and by more than 40% in New York since the beginning of the 2006/2007 season until the beginning of July. From the August to the end of the 2006/2007 season, cocoa prices in future markets moved upwards, supported by concerns over the impact on production of the spread of black pod disease in some regions of Côte d'Ivoire, Ghana, and to a lesser extent, Nigeria.

3.9.1   Factors That Affects Cocoa Prices.

As already stated, cocoa futures contracts are traded in London and New York with prices quoted in Great Britain Pounds / Metric Ton and US Dollars / Metric Ton. Cocoa is unique among soft

commodities in its linkage to two currencies; the GBP-USD exchange rate assures the relationship between these two exchanges and offers an active arbitrage market to traders. According to the New York Intercontinental exchange market (ICE), the GBP leads the price of cocoa by three calendar quarters, on average. Cocoa prices are affected by various factors including stock/grind ratios, anticipations for future production/demand, global food prices, and consolidation/fragmentation in cocoa trade and processing industries. These components generally set the tone for long-term progressions in cocoa prices while trading by investment funds tend to drive movement in the short-term. Over the past five years, the price of cocoa overall has increased, but it has been prone to volatility from 2008 through 2011, spiking to a 30-year high of $3,625/ton in January 2010 and dropping back to $2,200/ton in December 2011.

 Price inflations may be attributed to, among other factors, delayed transport of cocoa to ports, limited producer selling, lower stockpiles, extreme weather conditions such as intense dry or rainy periods, or/and political instability in producing countries.

 Price decreases may be attributed to, among other factors, favorable weather conditions, insecticides to farmers and subsidized distribution of fertilizers, expectations of a large crop or higher stockpiles, and/or decreased demand expectations among processors.

 Price movement is also highly influenced by hedge fund managers and speculators with short and long positions in cocoa. This activity serves as a driving force behind short-term volatility. Speculative buying (long position) results in an increase in price and selling (short position) results in a price decrease. Arbitrage between the two currency markets is an additional consideration. A weaker pound relative to the dollar puts dropping pressure on cocoa as the attractiveness of supplies traded in New York decreases. A stronger pound relative to the dollar leads to price increases due to the appeal of cheaper commodities in New York.

4 Practical Part

This chapter was concentrated on the criteria on how the data of the research were gathered, the research methodology used in the study. The studies specifically looked at the factors that are deemed to have an effect on production as well as price of cocoa in the three top producing countries in the world.

4.1 Organization of the Thesis.

The thesis is divided into six parts; Introduction and Literature review, Aims and methodology, Results and Discussion, conclusion and recommendations. The introductory part gives a general overview of Agriculture and cocoa production in the world. The Literature part reviews various studies on cocoa production in the world. The section gave a brief description of the cocoa industry of the top three producing countries and the importance of cocoa to the development of the countries. The factors which affect price and production of cocoa were also looked at in this section of the study. The methodology part describes the analysis tools that were employed in the thesis. Results and Discussion showed the results of the thesis and describes a qualitative analysis of the results obtained. The final part concludes the findings of the thesis and its implication for practice and further studies in the research area.

4.2 Research Design and Data Sources.

The study manly focused on the factors affecting cocoa production and prices of cocoa in the top three producing countries in the world. Notable factors such yield and exchange rate were known to have an effect on production and price respectively. Secondary data was mainly the data source for the research. Journals, articles, books, reports, statistical bulletin and other important internet sources were used to achieve the set objectives of the study. However, the use of internet literature was limited by the researcher as it is not a reliable source of data information for proper research work. Also, newspaper sources, official documents of the government of Ghana, Indonesia and Cote d'Ivoire and other public online database such as the World Bank (WB), Ghana Statistical Service (GSS), Ghana Cocoa Board (COCOBOARD), International Cocoa Organization (ICO) the Food and Agricultural Organization (FAO) and the World Atlas with relevance to the research were consulted.

4.3 Data Sampling and Analysis Procedure.

Quantitative data was sampled from the data base of World Bank (WB), Ghana Statistical Service (GSS), Ghana Cocoa Board (COCOBOARD), International Cocoa organization (ICO) the Food and Agricultural Organization (FAO), World Atlas and other sources. The research employed a 16 year time series specifically between the years 2000 and 2016. This period was chosen for the study because it reflects the trend in relationship among the variables employed in the study.

In terms of analysis, the study used a multiple regression analysis model to empirically analyze the relationship between the variables used for the study. Following the use of a regression model analysis, the following assumptions were made;

1. There is a significant relationship between cocoa production and government expenditure.

2. There is a significant relationship between cocoa production and technology improvement.

3. There is a significant relationship between price of cocoa and other related commodities.

4. There is a significant relationship between price of cocoa and Exchange rate.

4.4 Definition of Variables.

This section described the importance of the variables used in the empirical analysis of the study and helped in answering the set hypothesis above.

4.4.1 The impact of Government expenditure towards the cocoa industry.

Cocoa as stated in the literature is the backbone of the economy of the study countries, especially Ghana and Cote d'Iviore (Adjinah and Opoku, 2010). Expenditure of the government towards building a sustainable cocoa producing industry is very important. This study tried to find out if there is any significance in the expenditure by the government towards the cocoa industry has any impact on the production quantities of cocoa beans in the three study area. The author however placed critical consideration on the uneven development of the three study countries and also the difference in climatic conditions of the countries. However, the emphasis placed on production factors have been done on internal factors (input-output factors). This study however wants to study external influence by examining the effects of government expenditure on cocoa production. We therefore expect a positive significance relationship between government expenditure and production of cocoa.

4.4.2 The impact of technological improvement.

Technology helps in increasing efficiency in the use of limited resources for production. Cocoa production can be improved when the capacity of technology is increased. Considering again the differential development pattern of the three study countries, the impact of improved technology cannot be swayed away. Technology in this case is describing the ways of cultivating, harvesting and processing of harvested cocoa beans. The machinery, type of irrigation system, processing and

storage facilities available for the cocoa industry in the study countries are placed under technology usage for the purpose of the study. We therefore expect a positive significant effect of technology improvement on cocoa production.

4.4.3 The impact of price of alternate agricultural commodities.

The price alternate agricultural commodities was analyzed by the study to know if there is any impact of other agricultural products on the price of cocoa on the world market. The price of coffee was chosen as an alternative commodity to cocoa with the notion of its high consumption in most parts of Europe, America and Africa which are also chocolate consuming continents. The study therefore expects a negative significant impact of the price of coffee on the price of cocoa.

4.4.4 The impact of exchange rate.

All the three study countries have different currency usage. However, the selling of cocoa products is done on the USD rate on the world market. In reference to this, the study sort to find out the impact of exchange rate on the price of cocoa production in the three study areas. The development patterns of the countries were also considered as stabilization of the exchange is dependent on the economic and financial stability of the country. The study however has a point view of a positive impact of exchange rate on the price of cocoa.

4.5 Model Specification.

In order to investigate and analyze the factors that affect the production and price of cocoa and test for the proposed hypothesis, a multiple regression model is employed. Therefore, our baseline model could be specified as follows:

$$Y*_{it} = \beta_0 + \beta_i X_{ti} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Eq. 1$$

Extending Eq.1 to reflect all the explanatory variables, the following regression model is obtained:

$$Y*_t = \beta_0 + \beta_1 X + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots Eq.2$$

Where;

$Y*$ = the dependent variable (s)

X = the independent variable (s)

β_0 = A constant

β 1,...... n are regression coefficients to be estimated.

t= time

For the purpose of simplicity, the model is broken down as follows Y= f(x)

The multiple regression model was adopted following the studies done by Shamsudin et al., (1992), Boansi (2013) and Darkwah and Verter (2014).

4.5.1 Analysis of production factor model.

To analyze the factors that affect cocoa production as measured in the quantity of cocoa beans produced, the specified model given in (2) above was expanded to have the following model below.

QC = f (GEX, TECH, LAV, COP, ELEC) ……………….. (3)

Thus, the econometric model 3 is mathematically expressed as follow;

In QC = β_0 + β_1 In GEX_{it} + β_2 In $TECH_{it}$ + β_3 In LAV_{it} + β_4In COP_{it} + β_4 In $ELEC\ it$ + ε_{ti}............. (4)

Where: **QC** is Quantity of Cocoa beans produced, β_0 is the intercept of the regression line and the Y axis, **GEX** is Government Expenditure, **TECH** is Technological improvement, **LAV** is land available for production, **COP** is the Cost of Production and **ELEC** is the use of electricity.

4.5.2 Analysis of Price factor model.

To analyze the factors that affect cocoa price as measured in world spot price (USD), the specified model given in (2) above was expanded to have the following model below.

PC = f (WCfP, EXR, INF, WCOP, QP) ……………….. (4)

Thus, the econometric model 4 is mathematically expressed as follow;

In PC = β_0 + β_1 In WCP_{it} + β_2 In EXR_{it} + β_3 In INF_{it} + β_4In $WCOP_{it}$ + β_4 In $QP\ it$ + ε_{ti}............. (4)

Where: **PC** is the Price of Cocoa beans produced, β_0 is the intercept of the regression line and the Y axis, **WCfP** is World Coffee Spot Price, **EXR** is Exchange Rate, **INF** is Rate of Inflation, **WCOP** is the spot price of crude oil and **QP** is the Quantity of bean produced.

4.6 Model Estimation Tools.

Knowing and establishing the specification of the models to suit the variables employed in the study, the following estimation tools would be used following the rules inscribed by economic research laws;

1. Multiple regression theory as established above.

2. Statistical test significance (Ordinary Least Square for hypothesis under confidence level 0.05).

4.7 Data Analysis Techniques.

Statistical tools such as Excel (version 2010) and Statistical Package for Social Sciences V. 20 (SPSS version 20) would be used for the data analysis. Data obtained will be analyzed with use of standard statistical software using descriptive statistics. The objectives will be tested using multiple regression method. Data would be analyzed using frequencies with mode, mean and median indicated. Percentages will be worked out to indicate positions with measures of central tendencies and measures of dispersions. Dependent and independent variables will be used for regression analysis. Other data will be statistically treated for scientific, objective interpretations. Deriving from the above, data will be presented in tables, graphs, charts, etc. Findings will be deduced from these followed by logical conclusions which will form the basis for appropriate recommendations.

5 Results and Discussion

5.1 Results of the study.

This section of the study describes various data used for the research. It shows the presentation and analysis of data, explains outcomes of the analysis and makes inferences to the results obtained from the analysis.

5.1.1 Background of study area(s).

5.1.1.1 Côte d'Ivoire

Côte d'Ivoire is a West African country with rainforests, beach resorts and a French-colonial legacy. Abidjan, on the Atlantic coast, is the country's major urban center. Its modern landmarks include zigguratlike, concrete La Pyramide and Paul's Cathedral, a swooping structure tethered to a massive

cross. North of the central business district, Banco National Park is a rainforest preserve with hiking trails.

Cote d'Ivoire is one the world's largest producers and exporters of coffee, cocoa beans, and palm oil. Consequently, the economy is highly sensitive to instability in international prices for these products and to weather conditions. In spite of attempts by the government to diversify the economy, it is still largely dependent on agriculture and related activities, which engage roughly 51% of the population. After several years of lagging performance, the Ivorian economy began a comeback in 1994, due to improved prices for cocoa and coffee, growth in non-traditional primary exports such as rubber and pineapples, limited trade and banking liberalization, offshore oil and gas discoveries, and generous external finance and debt rescheduling by multilateral lenders and France. The 50 percent devaluation of Franc Zone currencies on 12 January 1994 resulted in a one-time jump in the inflation rate to 26% in 1994, but the rate fell to 2.5% in 1996 and 4.7% in 1997.

The agriculture sector in Cote d'Ivoire contributes 27.3% of the GDP and employs an estimated 51.1% of the labor force. The key primary food crops produced are bananas, cocoa beans, coconuts, green coffee, maize, rice, soybeans and sugar cane. The primary meat products are beef, chicken, game, goat, mutton and pork. The largest (in value terms) agricultural exports in 1997 were cocoa beans, coffee, fish, bananas and cotton lint. The total value of agricultural exports in 1997 was $2.2 billion, while the total value of agricultural imports in 1997 was $549.9 million.

5.1.1.2 Ghana.

Ghana is located in West Africa and shares boundaries with three countries, Burkina Faso in the North, Cote d'Ivoire in the West and Togo in the East. It shares a frontier in the South with the Gulf of Guinea (Refer to appendix for map of Ghana). The country's population in 2000 was 18,845,265 (GSS, 2002). It was estimated to be 23 million in 2007 (PRB, 2007) and currently stands at 25.6 million (GSS, 2012). With a land area of 238,537 sq. km, Ghana is administratively divided into 10 regions and 170 districts. In line with the decentralization policy of government, district assemblies were initiated in 1988 and charged with the implementation of national policies related to governance, education, health and agricultural development at the local level, contextualized to suit local priorities and needs.

Economic situation OF Ghana has been a concern for some time now. Gross Domestic Product was $12.5 billion and Per Capita Income was $540 in 2006. GDP growth has been positive and increasing since the economic reforms were instituted in 1983. The economy of Ghana grew by 6.2

percent in 2006 and percent in 2007 (ISSER, 2008). Prior to that, real GDP growth averaged 4.7 percent between 1997 and 2005 (ISSER, 2008). The country's economy is also donor-dependent. This is reflected in the yearly budgetary support the country receives from her development partners. For example in 2006, total grant disbursements to the country amounted to $565.0 million2 while multilateral HIPC assistance, programme grants and project grants also amounted to $56.6 million, $122.8 million and $189.7 million respectively. Total sum of loans for that year amounted to $359.5 million while exceptional financing of the budget, which was predominantly debt relief from the country's bilateral partners totaled $80.0 million (Republic of Ghana, 2007). Since 2001, the government of Ghana has achieved some success in stabilizing the macro economy. This was primarily at the instance of high gold and cocoa prices, and later the introduction of tighter fiscal, monetary and exchange rate policies. In 2002, Ghana's development strategies were consolidated into the Ghana Poverty Reduction Strategy (GPRS 2003-2005), now renamed the Growth and Poverty Reduction Strategy, 2006-2009.

5.1.1.3 Indonesia.

Indonesia which is officially the Republic of Indonesia is a unitary sovereign state and transcontinental country located mainly in Southeast Asia with some territories in Oceania. Situated between the Pacific and Indian oceans, it is the world's largest island country, with more than seventeen thousand islands. At 1,904,569 square kilometers (735,358 square miles), Indonesia is the world's 14th largest country in relation to land area and world's 7th largest country in terms of combined land and sea area. It has an estimated population of over 260 million people and is the world's 4th most congested country, the most populous Austronesia nation, as well as the most populous Muslim-majority country. The world's most populous island, Java, contains more than half of the country's population.

The economy of Indonesia has expanded strongly over recent decades, notwithstanding the sharp economic contraction that occurred during the 1997–1998 Asian financial crisis (Graph 1 and Table 1). This strong pace of development has seen Indonesia become an increasingly important part of the global economy. It is now the fourth largest economy in east Asia1 – after China, Japan and South Korea – and the 15th largest economy in the world on purchasing power parity (PPP) basis. Furthermore, its share of global output – currently just under 1½ per cent – is expected to continue to rise over the years ahead.

Over time, the formation of the Indonesian economy has changed considerably. Historically, the economy has been heavily weighted towards the agricultural sector, reflecting both its stage of

economic growth and government policies in the 1950s and 1960s to promote agricultural self-sufficiency. A gradual process of industrialization and urbanization began in the late 1960s, and escalated in the 1980s as falling oil prices saw the Indonesian Government focus on diversifying away from oil exports and towards manufactured exports (Goeltom, 2007). From the mid-1980s, trade barriers were decreased and the Indonesian economy became more globally integrated. Since the Asian crisis, Indonesia's relatively strong growth outcomes have been accompanied by reduced output volatility. Notably, Indonesia's economic growth slowed only moderately during the 2008–2009 global downturns, while there was a marked decline in output in most advanced economies and other east Asian economies (except China).

5.2 Analysis of model, results and interpretation.

5.2.1 Model analysis of the impact of government expenditure on quantity of production.

In QC = β_0 + β_1 In GEXit + β_2 In $TECH_{it}$ + β_3 In LAV_{it} + β_4In COP_{it} + β_4 In $ELEC\ it$ +ε_{ti}........ (4)

Hypothesis one (Null and Alternative)

H$_o$: a$_1$=0 There is no significant relationship between government expenditure and cocoa production.

H$_1$: a$_1$ ≠0 There is significant relationship between government expenditure and cocoa production.

5.2.2 Model analysis of the impact of cocoa production and technology improvement.

Hypothesis Two (Null and Alternative)

H$_o$: a$_1$=0 There is no significant relationship between technology improvement.and cocoa production.

H$_1$: a$_1$ ≠0 There is significant relationship between technology improvement.and cocoa production.

Decision Rule:

If p calculated < p at 0.05 significance level, we reject the null hypothesis (Ho) and accept the alternative hypothesis, otherwise, we accept it.

Also, if F- calculated > f- table (4.747), we conclude that the entire or overall regression result is statistically significant, otherwise it is not.

5.2.3 Model Result of the impact of government expenditure and technology improvement on cocoa production.

5.2.3.1 Model results for Cote d'Ivoire

Table 4 and 5 shows the model summary and emperical results for the impact of government expenditure and technology improvement on cocoa production in Cote d'Iviore.

Table 4: Summary results of the impact of government expenditure and technology improvement on cocoa production in Cote d'Iviore.

Model	R	R Square	F change	Sig. F Change
1	0.807	0.65	3.12	0.054[**]

Source: Authors own calculation based on FAO data (2017).

Table 4 shows the linear functional form for the regression analysis as it best fits the regression model employed and the best explains the variables in the study. The multiple coefficient of determination (R^2) for the regression model is 0.65 which shows that, 65 percent of the variations in the determinants of cocoa production in Cote d'Ivoire were explained by the variables included in the model. Also the F statistics given is (3.12) and this is significant at 1 percent significant level. This shows that, the regression is significant and as such the data best fits the model used.

The regression analysis table (5) below shows the impact of the variables used in the study with particular reference to government expenditure and technology improvement on cocoa production in Cote d'Iviore. Based on the null and alternative hypothesis proposed and the decision rule stated above, it can be seen that, both variables were significant at $p < 0.05$ since p value obtained for government expenditure and technology improvement were $0.058 < 0.05$ and $0.048 < 0.05$ respectively. This implies that, we can reject the null hypothesis and accept the alternative and therefore conclude that, there is a significant relationship between government expenditure and technology improvement on cocoa production in Cote d'Iviore. More so, looking at the coefficient for both variables reveals a positive coefficient which shows that, an increase in government expenditure towards agriculture in Cote d'Ivoire has an alternate increase in level of cocoa production in country by a factor of 79.26 units. Likewise, an improvement in the technology for cocoa production will lead to a huge boost in production quantities by a factor of 268056.092. This implies that, for Cote d'Ivoire to continue to be the world's number one producer of cocoa there should be an increased government expenditure coupled with improved technology.

Table 5: Regression analysis showing the impact of government expenditure and technology improvement on cocoa production

Variable	Coefficients	t	Sig.
	B		
(Constant)	15638737.582	1.528	.015
Government expenditure	79.275	.560	.058[**]
Technology input	268056.092	-.147	.048[**]
Land available	5394.416	-1.381	.019[**]
Cost of production	-184.350	-.700	.050[**]
Area Harvested	-.177	-.243	.081[**]
GDP	1469.174	1.433	.182

Dependent Variable: Quantity of production. Significant at p (0.05) **

Source: Authors own from FAO data base (2017).

Also, it could be deduced from the table that, other factors such as land available for cocoa production, the cost of production as well as total area harvested has an effect on the production quantities of cocoa in Ivory Coast. However, GDP was found not to have any significant effect on production quantities of cocoa but had a positive coeeficient which implies that, as the production of cocoa increases, there would be an alternate increase in the Gross Domestic Product of the country and vice versa.

5.2.3.2 Model results for Ghana.

Table 6 and 7 shows the model summary and emperical results for the impact of government expenditure and technology improvement on cocoa production in Ghana. Table 6 shows the linear functional form for the regression analysis as it best fits the regression model employed and the best explains the variables in the study. The multiple coefficient of determination (R^2) for the regression model is 0.91 which shows that, 91 percent of the variations in the determinants of cocoa production in Ghana were explained by the variables included in the model. Also the F statistics given is (27.94)

and this is significant at 1 percent significant level. This shows that, the regression is significant and as such the data best fits the model used.

Table 6: Summary results of the impact of government expenditure and technology improvement on cocoa production in Ghana.

Model	R	R Square	F change	Sig. F Change
1	0.97	0.91	27.94	0.00[**]

Source: Authors own calculation based on FAO data (2017).

The regression analysis table (7) below shows the impact of the variables used in the study with particular reference to government expenditure and technology improvement on cocoa production in Ghana.

Table 7: Regression analysis showing the impact of government expenditure and technology improvement on cocoa production

Variable	Coefficients	t	Sig.
	B		
(Constant)	1490894.77	0.984	.348
Government expenditure	34.242	2.119	.050[**]
Technology input	109237.71	0.329	.007[**]
Land available	121.466	1.054	.031[**]
Cost of production	-60.211	-0.425	.008[**]
Area Harvested	0.467	4.160	.002[**]
GDP	62.064	0.595	0.565

a. Dependent Variable: Quantity of production. Significant at p (0.05) **

Source: Authors own from FAO data base (2017).

Based on the null and alternative hypothesis proposed and the decision rule stated above, it can be seen that, both variables was significant at $p < 0.05$ since p value obtained for government

expenditure and technology improvement are $0.050 < 0.05$ and $0.007 < 0.05$ respectively. This implies that, we can reject the null hypothesis and accept the alternative and therefore conclude that, there is a significant relationship between government expenditure and technology improvement on cocoa production in Ghana.

More so, looking at the coefficient for both variables reveals a positive coefficient which shows that, an increase in government expenditure towards agriculture in Ghana has an alternate increase in level of cocoa production in country by a factor of 34.2 units. Likewise, an improvement in the technology for cocoa production will lead to a huge boost in production quantities by a factor of 109237.71. This implies that, there is the need for Ghana's government to shift its developmental attention to investing more into the cocoa industry as it is a major contributor to the GDP of the country. Also, it can be deduced from the results that, more technological improvement is needed to boost production of cocoa in Ghana whiles maintenance the quality of production. Storage facilities as well as processing are the most notable lacking infrastructure that the industry in Ghana lacks (Darkwah and Verter, 2014). Provision of such infrastructure will therefore attribute to an increase in the productivity of the cocoa industry in Ghana.

5.2.3.3 Model results for Indonesia.

Indonesia as stated in the literature part of this study, is the third largest producer of cocoa but first net exporter of the product outside Africa. Table 8 and 9 shows the model summary and emperical results for the impact of government expenditure and technology improvement on cocoa production in Indonesia.

Table 8 shows the linear functional form for the regression analysis as it best fits the regression model employed and the best explains the variables in the study. The multiple coefficient of determination (R^2) for the regression model is 0.829 which shows that, 83 percent of the variations in the determinants of cocoa production in Indonesia were explained by the variables included in the model. Also the F statistics given is (25.78) and this is significant at 1 percent significant level. This shows that, the regression is significant and as such the data best fits the model used.

Table 8: Summary results of the impact of government expenditure and technology improvement on cocoa production in Indonesia.

Model	R	R Square	F change	Sig. F Change
1	0.91	0.829	25.78	0.02[**]

The regression analysis table (9) below shows the impact of the variables used in the study with particular reference to government expenditure and technology improvement on cocoa production in Indonesia.

Table 9: Regression analysis showing the impact of government expenditure and technology improvement on cocoa production

Variable	Coefficients	t	Sig.
	B		
(Constant)	-603189.431	0.786	**.450**
Government expenditure	1.164	1.033	**.0038**[**]
Technology input	1775306.29	1.952	**.008**[**]
Land available	15.947	3.092	**.041**[**]
Cost of production	-353.631	-1.467	**.011**[**]
Area Harvested	-.192	-.243	**.173**
GDP	157.721	1.433	**.081**

a. Dependent Variable: Quantity of production. Significant at p (0.05) **

Based on the null and alternative hypothesis proposed and the decision rule stated above, it can be seen that, both variables was significant at p< 0.05 since p value obtained for government expenditure and technology improvement are 0.038 < 0.05 and 0.008< 0.05 respectively. This implies that, we can reject the null hypothesis and accept the alternative and therefore conclude that, there is a significant relationship between government expenditure and technology improvement on cocoa production in Indonesia. Also, taking a look at the coefficient for both variables reveals a positive coefficient which shows that, an increase in government expenditure towards cocoa production in Indonesia has an alternate increase in level of cocoa production in country by a factor of 1.16 units. Likewise, an improvement in the technology for cocoa production will lead to a huge boost in production quantities by a factor of 1775306.29.Noted as the biggest exporter of cocoa beans and its associated products outside Africa, results of the regression analyse proved that, an

increase in the government expenditure and the use of improved technology can help the growth of the cocoa industry. For Indonesia to overtake the two African giants in terms of production there is the need for an improved as well as increased in government expenditure and technological advancement in the cocoa industry of Indonesia. The country in recent times, have enjoyed a steady economic growth with export of cocoa as one main contributor to the success in growth.

Analysis of the factors that impact the production of cocoa in the top three producing countries in the world have revealed that, government expenditure as well as technological advancement all significantly affects the production of cocoa in these three countries. Also, other factors such as the cost of production, land available for production and total area harvested all significantly affects the production of cocoa in the top three countries. This results obtained is in line with the study of Fadipe et al. (2012) who found a positive relationship between farm size (area harvested) and production out in Nigeria. Adding to this, Vigner (2007) using correlation error method, found out that, there is a positive correlation and a significant effect on land cultivated and output. The author also concluded that, the cost of production is inversely proportional to the output of cocoa production. This finding is in line with the results obtained of this study.

Gross Domestic Product (GDP) was however found not to significantly affect the output potential of cocoa production in the top three cocoa producers in the world. This was in contrary to the studies done by Darkwah and Verter, (2014) and Izuchukwu (2011) who by the use of Coitegration model and multiple regression respectively, found out that, there is a significant relationship between GDP growth and cocoa production in Ghana. However, a positive coefficient was obtained which implies that, an increase in the GDP of all three countries wills subsequently increase the production of cocoa production.

5.3 Model analysis of factors that affect prices of cocoa.

To empirically analyze the factors that affect prices of cocoa, our base line model was as follows;

$$\text{In } PC = \beta_0 + \beta_1 \text{ In } WCP_{it} + \beta_2 \text{ In } EXR_{it} + \beta_3 \text{ In } INF_{it} + \beta_4 \text{In } WCOP_{it} + \beta_4 \text{ In } QP_{it} + \varepsilon_{ti} .... (4)$$

Where: **PC** is the Price of Cocoa beans produced, β_0 is the intercept of the regression line and the Y axis, **WCfP** is World Coffee Spot Price, **EXR** is Exchange Rate, **INF** is Rate of Inflation, **WCOP** is the spot price of crude oil and **QP** is the Quantity of bean produced.

The study based on the model specification proposed the following hypothesis;

Hypothesis Three (Null and Alternative)

H_o: $a_1 = 0$ There is no significant relationship between price of cocoa and other related commodities..

H_1: $a_1 \neq 0$ There is a significant relationship between price of cocoa and other related commodities.

Hypothesis four (Null and Alternative)

H_o: $a_1 = 0$ There is no significant relationship between price of cocoa and Exchange rate.

H_1: $a_1 \neq 0$ There is a significant relationship between price of cocoa and Exchange rate.

Decision Rule:

If p calculated < p at 0.05 significance level, we reject the null hypothesis (Ho) and accept the alternative hypothesis, otherwise, we accept it.

Also, if F- calculated > f- table (4.747), we conclude that the entire or overall regression result is statistically significant, otherwise it is not.

5.3.1. Emperical analysis results of the determinants of price of cocoa in the top three prodicing countries.

Table 10 shows the summary results obtained from the analys. It can be deduced from the table that, the linear functional form for the regression analysis as it best fits the regression model employed and the best explains the variables in the study. The multiple coefficient of determination (R^2) for the regression model is 0.698, 0.969 and 0.736 which shows that, 69%, 96%, 73% of the variations in the determinants of cocoa price in Cote d'Iviore, Ghana and Indonesia respectively, were explained by the variables included in the model.

Table 10: Summary results of the determinants of cocoa prices.

Country	R	R Square	F change	Sig. F Change
Ivory Coast	0.833	0.694	48. 4	0.013 [**]
Ghana	0.985	0.969	95.103	0.00 [**]
Indonesia	0.858	0.736	4.639	0.013

Source: Authors own calculation based data collected(2017).

The regression analysis tables 11, 12 and 13 below shows the impact of the variables used in the study with particular reference to the determinants of cocoa prices in Cote d'Iviore, Ghana and Indonesia.

Table 11: Regression results of the determinants of cocoa prices in Cote d'Ivoire.

Variable	Coefficients	t	Sig.
	B		
(Constant)	334981.605	0.988	.345
Price of CC	55.369	.834	.042[**]
Inflation	5151.64	-1.854	.0050[**]
Exchange Rate	-539.259	-862	.019[**]
Qty of prod	-.055	-1.183	.050[**]

Source: Authors own calculation based data collected (2017). Significant at p (0.05) **

Table 12: Regression results of the determinants of cocoa prices in Ghana.

Variable	Coefficients	t	Sig.
	B		
(Constant)	-90593.59	-2.329	.040
Price of CC	96.008	3.332	.007[**]
Inflation	-672.29	-0.695	.501
Exchange Rate	53432.612	5.704	.000[**]
Qty prod	0.003	0.063	.951

Source: Authors own calculation based data collected (2017). Significant at p (0.05) **

Table 12: Regression results of the determinants of cocoa prices in Indonesia.

Variable	Coefficients	t	Sig.
	B		
(Constant)	-2777364.3	-0.355	.729

Price of CC	202.830	.672	**.051**[**]
Inflation	-47305.337	-1.247	**.023**[**]
Exchange Rate	-28.407	-0.478	**.641**
Qty Prod	2.690	2.782	**0.01**[**]

Source: Authors own calculation based data collected (2017). Significant at p (0.05) **

Results obtained from tables 11, 12 and 13 revealed that, the price of a competitive commodity (Coffee) on the world market has a significant impact on the price of cocoa in all the top three cocoa producing countries. The level of significance obtain 0.042, 0.007 and 0.051 for Cote d'Ivoire, Ghana and Indonesia respectively are less than p at 0.05. We therefore cannot accept the null hypothesis based on the decision rule stated above and conclude that, there is a significant relationship between the price of cocoa and the price of a competitor commodity on the world market.

Another determinant that was observed was the effect of exchange rate. The signifance p value obtained for each of the studied countries showed that, exchange rate can be deemed as a determinant of price of cocoa. Values obtained was less than p at 0.05 and we therefore reject the null hypothesis and acccept the alternative and conclude that, the rate of currecy exchange (measured in USD) has a significant relationship with the price of cocoa. This results is in line with that of Bola (2007), Izuchukwu (2011) and Darkwah and Verter (2014). Bola (2007) working on the overview of the agricultural sector in Nigeria argued that, the rate of exchange has an impact on the prices of agricultural commodities and with cocoa as a main agricultural export of the country, stabilization of the exchange rate can help in the development of the agricultural sector of Nigeria. Adding to this, Darkwah and Verter also working on the determinants of cocoa output in Ghana, concluded that, exchange rate affects the price of cocoa at the spot market which in the long run will affect the incomes of farmers and therefore total capital available for production. In contrast to the reslts obtained, Imonikhe (2010) working on output and price of cocoa in Nigeria found out that, exchange rate has no imapct on production and hence cannot be a determinant of price of cocoa.

The quantity of cocoa produced was analyszed to assertain if it could be deemed as a contributing factor to price of cocoa in the top three cocoa producing countries. Results obtained in tables 11 and 12 showed that, there is no significant impact of quantty of cocoa produced on the price of

cocoa in Cote d'Ivoire and Ghana respectively. This results were in contradictory to the results of Darkwah and Verter (2014) who found out that, there is a significant positive relationship between quantity of cocoa produced and the price of cocoa. However, results obtained for Indonesia said otherwise to the top two countries. Significance level obtained proved that, there is a significant relationship between quantity of cocoa produced and the price of cocoa and this is in line with the results Darkwah and Verter (2014). The difference in results could be attributed to the differences in economies of the three countries as well as the geographical location and climatic conditions.

The last variable analayzed was the rate of inflation. This was included due to the fact that, inflatin controls prices of goods and services in a particular country. Results for the three studued countries showed that, inflation cannot the demeed as a determinant of price of cocoa.

6. Conclusion

The aim of the thesis is to find the factors that affect the prduction output of cocoa and the price of cocoa in the top three producing countries in the world. Cocoa production was found to play a critical role in the development of the three top cocoa producing countries especially in Cote d'Ivoire and Ghana were it contrubutes 44% and 25% to the GDP of thses countries respectively. Cocoa production has been the backbone of the Indonesian agricultural sector and with the current transformation of the economy, the export of cocoa products is noted to play a critical role and contributes about 13% to the GDP of the country.

The lack of farm inputs, technical skills and low level of eductaion of cocoa farmers was identified as critical and detrimental to the growth and development of the cocoa industry in the studied countries. Most farmers were found to be aging and the youth of the studied countries are not attracted by the industry. The lack of motivation of the youth to go into agriculture and hence the cocoa industry is very crucial to the development of the cocoa industry of the studied countries and therefore there is the need of governmnets of the countries to initiate programmes that will encouarage the youth to enter into the cocoa industry. Another important challenge that was found is the problem of infrastructure. Cocoa production is most often done where we call the hinter lands of the country and due to the lack or inadequecy of proper infrastrture, that is, proper storage, processing and transportation, most farmers do not store their harvest and therefore encounter high post harvest losses. This is a big problem especially for the two African cocoa producing countries, that is, Cote d'Ivoire and Ghana. The problem of infrastructure plays a critical role in both production and price and from the anaylesis results, the improvement of technology which can be

associated to the use of processing facilities as well as new cultivation methods was found to have a significant impact on production of cocoa in all three countries. It is therefore very important for the governments of these countries to improve on the infrastructure of the cocoa industries of their various countries. Most cocoa exports from the stsudied countries are done in the primary form without and value addition. This is because most of the countries do not have processing facilities to processed the products into secondary products which has higher value than selling in the primary form.

Investment into the cocoa industry will therefore curb the problem of infrastructure and as such boost the cocoa industry of the countries. Governmnt expenditure towards the cocoa industry was a variable that was considered in this study. The study results proved that, an increase in governmnet expenditure will subsequently harness the growth of the cocoa industry. This is of the fact that, with increase expenditure, there can be more research into productivity, that is, finding alternate productions ways, improving cultivation methods, building up infrasture and improving logistics of the industry. This when implemented will go a long way to help the general growth of the industry. Research and development will help the industry to find disease resistant cocoa varieties as pests and diseases was found to be an important challenge to the industry. Quality of cocoa produce was also found to be a major challenge in Cote d'Voire. Though the country is the leading producer of cocoa in terms of quantity, it is nowhere to be found in terms of quality. The government of Cote d'Ivoire, therefore need to improve on the quality of their produce by investing into research and development and as such must increase the expenditure towards the industry.

The research aslo found that the availablilty of land is a huge challenge to the cocoa industry especially in Ghana and Indonesia. The land tunre system (the ownership of land) is qiuite cumbersome and unclear and therefore, availability of land for agricultural purposes is very critical in the country. Though Ghana still maintains its quality of cocoa production, quantity of production has been reducing over the years as land for cultivation has been declining. The declining output nature in cocoa production in Indonesia is also attributed to availablilty of land though other factors such as pests and diseases and infrasture are to be considered. The issue of land is very crucial to the output potential of the cocoa industry and as the results of the study proved, land avalilabilty is signifaicant to the quantity of produce in all three major cocoa producing countries. The governments of the countries therefore need to improve upon the land tenure system, especially, that of Ghana to make land readily available for cocoa production. The roduction of cocoa has been a long tradition of the major producing countries and one problem associated to the production is the aging of cocoa trees. The age of the cocoa tree might be thought of not to have an impact on the

quantity of production and since this study did not statistically proved this, we cannot categorically emphasize on its impact. However, the age of the cocoa tree could help understand its resistance to pest and diseases. Older aged cocoa tress are more prone to pests and diesease which in the long run affects the cost of production incurred by the farmers in terms of controlling the pest and diseases. This therefore could be said to impact on production quantity of cocoa. Due to this, there is the problem of high cost associated to the production of cocoa in the major leading producers of cocoa in the world.

Income generation is the overall goal of every farmers and as such cocoa farmers are always trying to reduce cost and increase productivity to bring more profit. However, this is only feasible if the price of the produce is good enough to harness the income they require. One basic challenge facing the cocoa industry in the major producing countries is the volatility in price of the product. The unstableness of the price of cocoa causes a problem in the planning activities of farmers and therefore their overall income. One aspect of the study was to determine the factors that might affect the price of cocoa on the world market. The study resut showed that, the price of an alternative or competitive commodity (Coffee) had a significant impact on the price of cocoa on the world market. Also, exchange rate was deemed as a significant variable that might affect the price of cocoa. Due to different currencies being used by the three major producing countries, any fluctuations in the dollar rate affects the price of cocoa in any given point in time. Thsi in the long run affects the income of the farmers. The Ghana Cocoa regulatory board in attempt to salvage the unstableness of the price of cocoa, set a price ceiling for the selling of cocoa and its related products. However, the problem of this programme is that, with an increase in the price of cocoa on the world market, there is no change in the selling price of the cocoa on the local market. This affects the income of the farmers but an advantage to the reguatory board.

In conclusion, the study found out that, factors such as government expenditure, technological improvement, land availablilty and cost of production are determinants of quantity of production in the three major cocoa producing countries. On the price side, exchange rate as well as the price of alternative agriculture commodity (coffee) can determine the pice of cocoa. However, inflation was not deemed to have a significant impact on th price of cocoa. Governments of the studied countries therefore need to implement policies that will bring about a sustainable cocoa industries in the studied area.

6.1 Recommendations.

The study results obtained showed that, the cocoa industry of the three studied countries plays a critical role in the economic developemnt of the nations. We therefore based on the study reslts proposed the following recommendations;

1. Policy makers must draw policies that will enable an increase in production of cocoa by formulating laws that can help curb the diminishing land for other non agricultural purpose. This will make land more readily avaliable for the production of cocoa.

2. Value addition is very important in the commodity valus chain and therefore there is the need for technology improvement in the sector and hence increase in government expenditure towards the cocoa industry.

3. Policy makers must ensure that, fair prices are given to cocoa producers to improve the living standards by increasing their income level and over all poverty reduction in the cocoa producing areas.

4. Production of cocoa should be made attractive to the youth to venture into the industry by providing attractive incentives and provision of subsidies, machinery and other forms of farm inputs. Financial support should also be provided to enahance smooth running of production.

5. Further research should be done on areas not covered by this study. Governance specific and economic specific factors should be analyzed to find how they inpact the production of cocoa.

7. References

1. Acquaah, B., (1999). *Cocoa Development in West Africa (The Early Period with particular , B. (1999): Cocoa Development in West Africa (The Early Period with particular),* Accra, Ghana.: Ghana Universities Press.

2. Adjinah, K. & Opoku, I., (2010). *The National Cocoa Diseases and Pest Control (CODAPEC): Achievements and Challenges,* Accra: Myjoyonline.com .

3. Afoakwah, E. O., P, A., Fowle, M. & Ryan, A., (2008). Flavor Formation and Character in Cocoa and Chocolate: A Critical Review. *Critical Reviews in Food Science and Nutrition,* 48(9), pp. 88-109.

4. Aikpokpodion, P., (2010). Variation in agro-morphological characteristics of cacao, Theobroma cacao L., in farmers' fields in Nigeria.. *New Zealand Journal of Crop and Horticultural Science. ,* 38(2.), pp. 157-170.

5. Arnould, E., A, P. & Ball, D., (2009). Does fair-trade deliver on its core value proposition: Effects on income, educational attainment, and health in three countries.. *Journal of Public Policy and Marketing,* 28(2), p. 186–201..

6. Aryeetey, E., (2007). *State of the Ghanaian Economy.,* Legon, Ghana.: Institute of Social, Statistical and Economic Research..

7. Asfaw, S., Mithofer, D. & Waibel, H., (2010). What impact are E.U. supermarket standards having on developing countries' export of high-value horticultural products: Evidence from Kenya. *Journal of International Food & Agribusiness Marketing,* 22(3), p. 252–276..

8. Basso, K., K, S., Renner, T. & Pfann, M., (2012). *Cocoa Certification Study on the costs, advantages and disadvantages of cocoa certification commissioned by The International Cocoa Organization (ICCO),* The Netherlands.: KPMG Advisory.

9. Boansi, D., (2013). *Export performance and macro-linkages: A look at the competitiveness and determinants of cocoa exports, production and prices for,* Accra: MPRA Paper.

10. Bola, O., (2007). *Nigeria Agricultural Sector Oxford University Press Central Bank of Nigeria 2007,* Oxford : Oxford University Press.

11. Bowers, J. et al., (2001). MSH-MLH complexes formed at a DNA mismatch are disrupted by the PCNA sliding clamp.. *Journal of Molecular Biology,* 306(5), pp. 957-68.

12. Cramer, D. A., Barton, R. A., Shorland, F. B. & Chochanska, Z., (1967). A comparison of the effects of white clover (Trifolium repens) and of perennial ryegrass (Lolium perenne) on fat composition and flavour of lamb. *Journal of agriculture Science,* 69(6), pp. 367-373.

13. Darkwah, S. A. & Verter, N., (2014). AN EMPIRICAL ANALYSIS OF COCOA BEAN PRODUCTION IN GHANA. *European Scientific Journal,* 10(16), pp. 295-309.

14. David, A., (2012). *Cocoa Value Chain- Implication for the Smallholder Farmer in Ghana.* Accra: University of Ghana..

15. Dorward, A. & Kydd, J., (2004). The Malawi 2002 Food Crisis: The Rural Development Challenge.. *Journal of Modern African Studies,* 32(1), pp. 73-89.

16. Duguma, B., Gockowski, J. & Bakala, J., (2001). Smallholder cacao (Theobroma cacao Linn) cultivation in agroforestry systems of West and Central Africa: challenges and opportunities. *Agroforest System,* p. 177–188.

17. Fadipe, E. A., H, A. A. & Ilori, T. E., (2012). Economic analysis of cocoa production in Oyo state, Nigeria. *NJAFE,* 8(4), pp. 58-63.

18. Gianfagna, T. J. & Cooper, R., (2012). From Herbs to Medicines: Cocoa–Food and Medicine of the Gods.. *Alternative and Complementary Therapies,* 18(2), pp. 84-90.

19. Gockowski, J. & Sonwa, D., (2008). *Biodiversity and Smallholder Cocoa Production Systems in West Africa,* Lagos: STCP .

20. Gollin, D. & Parente, S. R. R., (2002). The Role of Agriculture in Development. *American Economic Review,* 92(2), pp. 160-164.

21. Goyal, A., (2010). Information, Direct Access to Farmers, and Rural Market Performance in Central India. *American Economic Journal: Applied Economics,* 3(2), pp. 22-45.

22. Guest, D. & P., K., (2007). *Vascular-Streak Dieback: A New Encounter Disease of Cacao in Papua New Guinea and Southeast Asia Caused by the Obligate BasidiomyceteOncobasidium theobromae.,* Imdonesia: Sulawesi international seminar on cocoa.

23. Gyamerah, E. A., (2007). *PROBLEMS MILITATING AGAINST LICENSED COCOA BUYING COMPANIES IN THE INTERNAL MARKETING OF COCOA,* Accra: Daily Graphic.

24. Izuchukwu, O., (2011). Analysis of the Contribution of Agricultural Sector on the Nigerian Economic Development.. *World Review of Business Research,* 1(1), pp. 191 - 200.

25. Junaid, M., (2015). *Cocoa Farming in Indonesia:Present Challenges,* Hasanuddin: The University of Hasanuddin, Indonesia.

26. Kolavalli, S. & Marcella, V., (2011). *"Cocoa in Ghana: Shaping the Success of an Economy",* Washington : The World Bank..

27. Kwanashie, M., Gurba, A. G. & Ajilima, I., (1998). *Policy modeling in agriculture, testing the response of agriculture to adjustment policies in Nigeria.,* Lagos: African Economic Research Consortium.

28. Lass, R., (1999). *Replanting and rehabilitation of old cocoa farms.* Cocoa Fourth Edition ed. New York: Tropical Agriculture Series, Longman.

29. Laven, A., (2010). *The risks of inclusion: shifts in governance processes and upgrading opportunities for cocoa farmers in Ghana,* Amsterdam: University of Amsterdam..

30. Livingstone, D., Royaert, S. & C., S., (2012). Making a Chocolate chip: development and evaluation of a 6K SNP array for Theobroma cacao.. *DNA Research: An International Journal for Rapid Publication of Reports on Genes and Genomes,* 22(4), pp. 279-291.

31. Manonmani, V., Vanangamudi, K., R.S.V, R. & Vinaya, R.,(2013). Effect of seed size on seed germination and vigour in Pongamia pinnata.. *Journal of Tropical Scence,* 1(5), pp. 1-5.

32. Mark & F., (2015). *Amenfi farmers blame officials for corruption.,* accra: Ghanalive.

33. Natawidjaja, H., (2009). *Current status and control program of pest and disease on cocoa in Indonesia.* Bali,, International cocoa conference in Grand Hyatt Hotel..

34. Opoku, A., Ndlovu, I., Terblanche, S. & Hutchings, A., (2006). In vivo hepatoprotective effects of Rhoicissus tridentata sub sp. cuneifolia, a traditional Zulu medicinal plant, against CCl4-induced acute liver injuryin rats.. *South African Journal of Botany.,* 7(2), p. 372–377.

35. Piesse, J., Thirtle, C. & Lin, L.,(2003). The Impact of Research-Led Agricultural Productivity Growth on Poverty Reduction in Africa, Asia and Latin America.. *World Development,* 12(31), pp. 1959-1975.

36. Purwantara, A. et al., (2009). *New symptoms and increased incidence of vascular-streak dieback (VSD) of cocoa in Indonesia – possible causes, studies required andcontrol..* Makassar, International Seminar in Gedung Pertemuan Ilmiah UNHAS..

37. Reardon, T., Barrett, C., Kelly, V. & Savadogo, K., (1999). Policy reforms and sustainable agricultural intensi-fication in Africa.. *Development Policy Review,* 17(4), p. 375–395.

38. Samuels, G., Ismaiel, A. & Rosmana, M. J., (2013). *Vascular streak dieback of cacao in Southeast Asia and Melanesia: in planta,* Indonesia: Coffee and Cocoa Research Institute..

39. Sari, N. & Baon, J., (2013). *Sustainable Cocoa Production in Indonesia by Optimizing Macronutrient Cycle in Cocoa Farms.* Makassar., Sulawesi international seminar on cocoa..

40. Schultz & T.W., (2007). *Transforming Traditional Agriculture. ,* New Haven, CT.: Yale University Press.

41. Shamsudin, M. N., Ann, C. T. & Rosdi, M. L., (1992). An Econometric Analysis of Cocoa Prices: A Structural Approach.. *Jurnal Ekonomi Malaysia,* 25(1), pp. 3 - 17.

42. Vigneri, M., (2007). *Drivers of cocoa production growth in Ghana.,* Accra: ODI Project Briefings.

43. Wahyudi, T. M. & Drajat, B., (2013). *Cocoa,* Makassar.: Indonesian Coffee and Cocoa Research Institute. .

44. Wood, G. A. R., Lass & A., R., (2008). *Cocoa.* 4th ed. ed. Oxford: Blackwell Science.

45. Zakiya, Z. & Pramesti, O., (2012). *Indonesia Targetkan Jadi Penghasil Kakao-Terbesar Di Dunia..* [Online]
Available at: nationalgeographic.co.id. [Accessed 20 January 2017].

46. Zeitlin, A., (2006). *Market Institutions and Productivity: Microeconomic Evidence from Ghanaian Cocoa,* Oxford: University of Oxford, Centre for the study of African Economics.

Tables and Figures

Tables

Figures

Appendixes

Figure 1: Criollo variety of cocoa.

Figure 2: Forastero variety of cocoa

Figure 3: Trinitario variety of cocoa

Table (Add table number): Production factors for Cote d'iviore.

Cost of production	Area Harvested	Land available	Area Equipped for Irrigation	Technology input	Price of Cocoa	GDP
615.95	2000000	2800	73	0.7	228650	646.66
782.33	1777550	2800	73	0.41	250000	663.64
1201.22	1880000	2800	73	0.5	281120	718.45
1599.90	2000000	2800	73	0.51	300000	875.09
552.12	2050000	2800	73	0.55	300000	929.89
803.72	2193548	2800	73	0.52	300000	942.22
925.02	2281290	2800	73	0.54	350000	962.92
976.57	2372542	2900	73	0.56	375000	1078.54
1441.70	2300000	2900	73	0.50	400000	1257.68
1610.23	2176162	2900	73	0.48	400000	1233.3
2587.64	2308453	2900	73	0.40	400000	1236.08
2574.16	2690468	2900	73	0.42	400000	1253.91
2329.12	2741142	2900	73	0.37	400000	1283.61
2394.99	2724080	2900	73	0.34	200000	1448.74
2265.73	2748357	2900	73	0.31	200000	1545.96
2183.44	2745075	2900	73	0.28	200000	1643.18
2101.14	2748682	2900	73	0.25	200000	1740.4

Source: FAO, 2017

Table (Add table number): Production factors for Ghana.

Cost of production	Land available for production	Area Harvested	Area Equiped for Irrigation	Technology input	Price of Cocoa	GDP
180.08	14430	1500000	31	0.59	944	424.19
188.80	14510	1350000	31	0.55	1778	441.46
266.17	14631	1195000	32	0.53	3330	499.37
503.40	14835	1500000	32	0.64	4000	602.4
736.67	15100	2000000	33	0.62	5330	682.95
734.09	15100	1850000	33	0.58	12000	804.06
732.43	15300	1835000	34	0.52	14000	929.78
602.82	15400	1463000	34	0.58	26660	1098.97
776.63	15600	1822500	34	0.61	52160	1234.13
828.40	15600	1600000	34	0.71	80260	1095.5
1060.76	15620	1600200	34	0.67	101250	1323.08
1270.70	15720	1600300	34	0.69	153750	1587.13
1296.65	15700	1600300	34	0.67	160000	1641.8
1210.93	15700	1600300	36	0.66	160000	1827.15
1328.88	15700	1600300	36	0.65	160000	1387.88
1376.52	15700	1600300	39	0.64	230000	1507.89
1424.17	15700	1600300	45	0.63	230000	1466.65

Source: FAO, 2017

Table (Add table number): Production factors for Indonesia

Government expenditure	Cost of production	Land available for production	Harvested Area	Area Equiped for Irrigation	Technology input	Price of Cocoa	GDP
10105.71	420.16	47177	749917	5500	0.28	460800	830.58
295.64	445.26	47700	765405	5745	0.28	522400	796.61
620.96	605.60	48181	776901	6000	0.28	1319809	958.39
643.21	773.64	51006	961107	6250	0.33	1331906	1134.63
627.96	753.20	53366	1090960	6500	0.35	1025514	1224.81
742.59	696.02	51846	1167046	6722.3	0.37	852775	1345.26
47430.74	746.58	51500	905730	6722	0.40	852775	1693.1
37214.3	853.48	53000	923968	6722	0.42	963630	1981.05
48042.15	1170.46	54000	1425216	6722	0.45	1137000	2308.18
55204.39	1294.07	55600	1587136	6722	0.47	1668600	2409.18
101632.6	1756.74	55600	1651539	6722	0.50	2427800	3125.22
90219.49	1564.76	56500	1732600	6722	0.52	1719300	3647.63
114609.7	1444.19	56500	1852900	6722	0.55	1396300	3700.52
147576.81	1302.97	57000	1740600	6722	0.57	1331000	3623.53
158697.97	1146.69	57000	1727400	6722	0.60	1331000	3491.93
157559.25	998.51	57000	1648133	6722	0.62	1331000	3360.33
149483.07	850.32	57000	1585383	6722	0.65	1331000	3228.73

Source: FAO, 2017

Factors affecting Price for Indonesia