CHRISTIAN SERVICE UNIVERSITY COLLEGE

ASSESSING THE ROLE OF FARM MANAGEMENT PRACTICES IN ENHANCING COCOA PRODUCTION IN WESTERN NORTH REGION OF GHANA

BY

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SEPTEMBER 2023

DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this University or any other University.

Candidate's Signature ……..... Date ……

Name: Bediako Agyeman

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of the dissertation laid down by Christian Service University College.

Supervisor's Signature: ..... Date: .....

Name: Bernard Adjei Poku (PhD)

ABSTRACT

Cocoa has been the most important cash crop in Ghana, contributing significantly to the country's GDP and providing a significant source of income for a lot of households. The government, in trying to support the cocoa sector, has implemented several measures to help farmers achieve maximum cocoa output. However, there are still challenges in the sector. This study looked at the management practices adopted by farmers and its impact on cocoa yield in the Western North Region of Ghana. Using a mixed-method approach, questionnaires were administered to 200 farmers in the Western North region, using a multi-stage sampling technique (cluster and convenient sampling). The study revealed that farmers perceived both natural and anthropogenic factors as having an effect on cocoa yield. The natural factors include rainfall and temperature whilst the anthropogenic factors include some farm management practices. Also, the majority of farmers engage in practices such as fertilizer application, spraying of insecticides and fungicides, pruning and the use of hybrid seeds to increase cocoa yield, whiles practices such as hand pollination, irrigation and planting of shade trees are least practised by farmers. Farmers faced some challenges in farm management practices which include inadequate education and training, financial constraints and political factors. It is therefore recommended that the government, through the Ministry of Food and Agriculture should ensure that more extension officers are sent to cocoa farming communities to educate the farmers on the best farm management practices. Also, special arrangements should be made for farmers to be provided with financial resources to enable them to acquire farm inputs and depoliticization of government interventions in the cocoa sector.

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DEDICATION

This work is dedicated to my wife Kate Akosua Kinto, my children who have been an inspiration to me towards achieving this feat, and to the memories of my late parents and Seanwoansa Seanwoabra Atta Agyeman (Sefwi Bekwaimanhene).

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CHAPTER ONE

INTRODUCTION

Background

Cocoa production in Ghana is mainly concentrated in the forested areas of the country (Figure 1-1) where the climatic conditions are favourable for growing cocoa (Boateng et al., 2014). It is predominantly produced by small-scale farmers with average farm sizes of approximately 23 hectares per farmer (Asante-Poku and Angelucci, 2013). Tetteh Quashie who brought cocoa pods from Fernando Po to establish a farm at Mampong Akuapem in the Eastern Region in 1879 first introduced cocoa cultivation in Ghana (Essegbey and Ofori-Gyamfi, 2012; Leiter and Harding, 2004). Most farmers in the sub region cultivated oil palm then, but with the fall in the price of palm oil globally, most of them switched to cocoa (Kolavalli and Vigneri, 2018; Leiter and Harding, 2004). An increase in the number of commercial migrant farmers acquiring forestlands for cocoa production expedited the spread of cocoa cultivation through Ashanti and Brong-Ahafo regions to the Western Region (Boateng et al., 2014; Kolavalli and Vigneri, 2011). The Western Region currently produces over 50% of total annual harvest, followed by the Ashanti region (16%) and then Eastern and Brong Ahafo regions, which together produce about 19% (Acheampong et al., 2014; Asante-Poku and Angelucci, 2013).

Until the late 1960s, Ghana was the leading producer of cocoa in the world, but then faced a major decline in production, which nearly ended the sector in the early 1980s (Essegbey and Ofori-Gyamfi, 2012; Kolavalli and Vigneri, 2011; Leiter and Harding, 2004). This crisis initiated a series of economic reforms that included increases in farm gate prices, introduction of free pest and disease control programs, the introduction of packages of hybrid seeds, fertilizers, insecticides and fungicides,

improved marketing facilities, and the repair of roads in cocoa growing areas (Wessel and Quist-Wessel, 2015). These interventions resulted in a gradual increase in production from the 1990s, largely between 2001 and 2003 (Kolavalli and Vigneri, 2011). Ghana is currently ranked second in terms of the quantity of cocoa beans exported, after Cote d'Ivoire. This export position has been sustained since 2005 and reached a record high of 1,004,000 MT in 2011 (Acheampong et al., 2014; Asante-Poku and Angelucci, 2013; Wessel and Quist-Wessel, 2015). In terms of quality, Ghana's cocoa is ranked number one as the world leader in producing premium quality cocoa (Amankwah-Amoah et al., 2018; Gockowski et al., 2011) because of its relatively high fat content and low levels of debris, resulting in high cocoa butter yields and low levels of bean defects. These characteristics, coupled with the farmers' careful fermentation and drying process produce a distinct cocoa liquor flavour (Gilbert, 2009; Kolavalli and Vigneri, 2011)

Since 2011, the production of cocoa saw fluctuations, reaching a decade record low of 740 000 tonnes in 2015 and picking up to 970 000 tonnes in 2017 (The statistics Portal, 2018). With increasing global demand for cocoa, there is the need to close the yield gap by addressing the causes of low yield on smallholder farms in a sustainable way. Many factors have been identified as influencing the production of cocoa. While some have been linked to natural causes such as climate change and soil fertility, others have focused on anthropogenic factors such as poor farm management practices and planting low-yielding varieties (Kongor et al. 2018). Both of the natural and anthropogenic causes may affect the production of cocoa.

Essential stakeholders in the cocoa sector, such as the Cocoa Research Institute of Ghana have made several appeals for cocoa farmers to adopt modern technologies and best management practices to improve cocoa yields. It is quite shocking that amid

these calls, the adoption rate is somehow low (Asamoah, 2015). According to Ramankutty et al. (2018b), perceptions of farmers on the attributes of innovations greatly influence adoption rates. Similarly, Ehiakpor et al. (2016), conclude that there is a positive relationship between perception and adoption. Thus, perceptions are fundamental in ensuring farmer adaptation to climate change and variability and addressing their associated challenges.

However, very little is known with regards to practices engaged in by farmers that target anthropogenic and natural factors that affect cocoa production. Questions such as the management practices cocoa farmers have employed in dealing with natural issues such as climate change; the awareness of farmers to certain factors that affect cocoa production, perceptions of how public policies affect cocoa production among others are very important in addressing issues with cocoa production. The study reveals that farmers are engaged in some farm management practices such as fertilizer application, spraying, pruning and planting hybrid seeds while practices such as hand pollination, irrigation and planting of shade trees are limited. Political factors are also responsible for poor practice of some farm management practices as the study reveals in the findings.

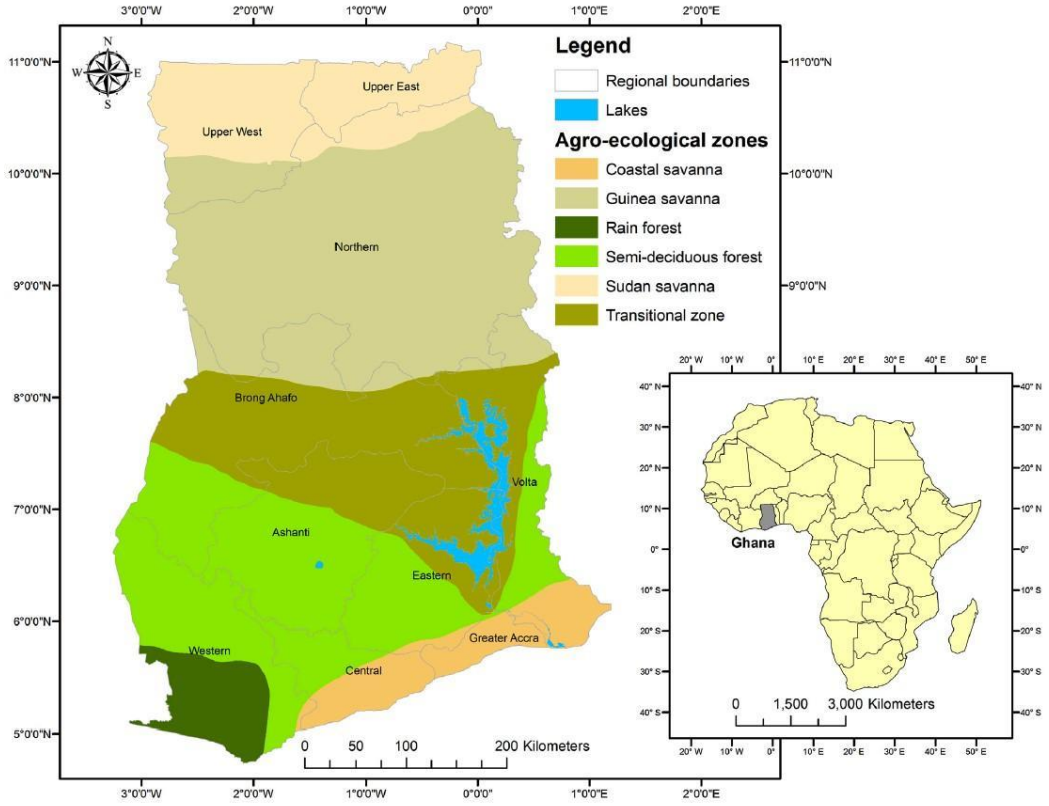

Figure 1: Agro-ecological Zones of Ghana

Problem Statement

Cocoa has significant livelihood support for communities primarily within the forest regions of Ghana. Cocoa production has been a supporter of the education of many children and source of collateral for communities in cocoa-growing areas in Ghana. Aside from its support for families mostly in rural areas, it also contributes immensely to the economic development of Ghana concerning foreign exchange earnings, income, and support for other sectors such as health, employment and education. The importance of cocoa to households in Ghana to a report by the Food and Agricultural Organisation (2018), which indicates that poverty rates in cocoa-growing households have halved since 2005. Low cocoa productivity, therefore, has various externalities both at the micro and macro levels.

According to Meemken & Qaim (2018b), poor farm management practices account for one of the reasons why farmers record poor cocoa yield. Adopting bad farm management practices leads to the spread of pests and diseases which affect cocoa yields (Aikpokpodion, 2019b). When cocoa yields reduce, households whose livelihoods depend on cocoa cultivation lose significant income which contributes to poverty because of the inability to provide essential services to its members. At the macro level, low cocoa output has implications on the foreign exchange received from the export of cocoa. The low foreign exchange has negative consequences on the economy in totality because cocoa is the most important cash crop for the Ghanaian economy. Local cocoa exports affect the exchange rate as well as stifles development due to reduced government revenues.

In view of the above, the government has been introducing programmes with the aim of ensuring improvement in the production of cocoa. Over the past two decades, programmes such as cocoa mass spraying exercise, subsidies on fertilizer, and the recent hand pollination exercise which began in 2017 have been some of the intervention programmes brought by the government to improve the production of cocoa ("COCOBOD launches artificial pollination," 2017). Also, producer prices of cocoa are reviewed upwards occasionally to encourage more people to go into cocoa farming to ensure high productivity in the cocoa sector (Laven and Boomsma, 2012). Although all these efforts mentioned above are in place to ensure growth in the output of cocoa, experiences of unstable production still exist.

A plethora of literature exists when it comes to factors that affect cocoa yields. While some concentrate on the physical factors including climate change and diseases (Danso-Abeam and Baiyegunhi, 2018; Andres et al., 2018; Asante et al., 2017), others look at the socio-cultural and economic determinants of cocoa production (Abbey et

al., 2016; Curry et al., 2015). One area that has been least explored in the debate around the factors that influence cocoa output is the perception held by cocoa farmers in terms of farm management practices and how these management practices affect yields. According to Codjoe et al. (2013), farmers in Ghana are aware of the factors that affect cocoa yield. However, adaptation strategies employed by farmers are directly related to the perceptions of farmers on the impacts of management practices (Awudzi et al., 2016). Studies that concentrate on practices by farmers in reaction to physical and anthropogenic challenges that influence the yield of cocoa are limited in the literature. When farmers hold perceptions that are not in line with standards and guidelines set to improve cocoa production, the cocoa output is indirectly affected negatively. Therefore, towards filling the perception gap in this area, this study looks at the perception of cocoa farmers on-farm management practices and its impacts on cocoa yields. The study targets cocoa farmers in the Western North Region of Ghana by looking at management practices engaged in by cocoa farmers and how these practices determine the overall cocoa yield in the study area. It seeks to contribute to existing knowledge by investigating the practices by farmers that influence output in cocoa yield to understand why cocoa production is on the decline in the study area.

Research Objectives

The overall objective of the study assesses the role of farm management practices in enhancing cocoa production in Western North Region of Ghana.

The specific objectives will include the following:

1. To examine the trend in cocoa production from 2007-2017.
2. To assess farmer perceptions of factors that influence cocoa production.
3. To examine farm management practices that influence cocoa production.

4. To analyze challenges associated with cocoa farm management practices.

Research Questions

1. What is the trend of Cocoa production from 2007 – 2017?
2. What are the perceptions of factors that influence cocoa production?
3. What are the farm management practices that influence cocoa production?
4. What are the challenges associated with cocoa farm management practices?

Significance of the Study

The findings of this study augment existing knowledge on the continued profitability and sustainability of the cocoa industry in Ghana. The findings can serve as a springboard for further research on Ghana's cocoa industry. It is especially useful to farmers who want to expand their scope of cocoa operations or to entrepreneurs who may want to start cocoa farming. Their awareness of best farm practices and its influence on cocoa production would enable them to maximize their profit from their operations. Also, the study is useful for investors and business people who seek to devote resources or capital in the cocoa sector. Most importantly, the Ghana government and COCOBOD may benefit from this study because awareness of practices that increase or decrease cocoa yields will help in the formulation of policies and education on cocoa yield maximization in the country to boost the cocoa sector.

Organization of the Study

The study is organized into six chapters, the first chapter commences with the introduction, including the study background, statement of the problem, research questions, objectives of the study, hypothesis and significance of the study. Chapter Two is the literature and theoretical review section. A review of relevant literature on the origin of cocoa, its production in the country and the importance of cocoa to the

nation as well as factors that determine cocoa production are discussed. Also, theories that are related to cocoa production are discussed in this section. The third chapter focuses on the study area and the methodology used in the study. Background information of the study area is discussed, followed by the research design, sources of data, sample size determination and sampling techniques, among others. Chapter four contains the results and discussions of this study findings. Chapter five contains the summary, conclusions and recommendations of the study based on the study findings.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter provides a review of three major areas. These include the literature review, theoretical review and the conceptual framework. The literature review consists of the overview of cocoa production in Ghana, challenges in the cocoa sector, factors that affect cocoa production, and the management practices in cocoa farming. The second section of the chapter discusses the theory on which the study is based, which is the diffusion of innovation theory. The last section discusses the conceptual framework of the study, which is based on the literature and theoretical review.

Overview of Cocoa Production in Ghana

It is documented that cocoa originated around the headwaters of the Amazon River in South America and it was used for drinks and chocolate by the locals before it was exported to Europe in the 16th and 17th centuries from South America (COCOBOD, 2019). The Spanish started large scale cocoa plantations in Brazil before it spread to other parts of the world. Dutch missionaries cultivated cocoa in the coastal belt of the Gold Coast around 1815 with the Basel Missionaries also planting cocoa in 1857 in Aburi.

However, these did not result in the spread of cocoa cultivation until Tetteh Quarshie, a native of Osu, Accra, who had travelled to Fernando Po and worked there as a blacksmith, returned in 1879 with Amelonado cocoa pods and established a farm at Akwapim Mampong in the Eastern Region.

Farmers bought pods from his farm to plant, and cultivation spread from the Akwapim area to other parts of the Eastern Region (COCOBOD, 2019).

In 1886, Sir William Bradford Griffith, the Governor, also arranged for cocoa pods to be brought in from Sao Tome, from which seedlings were raised at Aburi Botanical Garden and distributed to farmers.

Trends in Cocoa Growth in Ghana

Cocoa has gone through a series of critical expansions and contractions after it was introduced in the 19th century. According to Kolavalli and Vigneri (2011), four distinct phases can be identified with regards to cocoa production in Ghana which include the introduction and exponential growth (1888–1937); stagnation followed by a brief but rapid growth following the country's independence (1938–64); near collapse (1965–82); and recovery and expansion, beginning when the Economic Recovery Programme was initiated in 1983.

With regards to the exponential growth period which is the period between 1888-1937, it saw the introduction of Cocoa in the southern region of the Gold Coast in the mid-19th century by farmers from Akuapem and Krobo who can be found in the Eastern region. These farmers moved to Akyem to purchase lands from the chiefs for cocoa cultivation (U. N. C. O. T. A20, 17d). This move by the farmers was orchestrated by the fall in world prices for palm oil around 1885, an increase in exports for rubber, pressure on Akuapem lands and the establishment of produce buying companies in the coast to trade the new crop of cocoa ((U. N. C. O. T. A20, 17d)). Cocoa cultivation spread into the Ashanti and Brong Ahafo regions, enabling Ghana to be the highest producer of cocoa in the world between 1910 and 1914. By 1927, 84% of exports constituted cocoa with production reaching 300,000 tons (Hill, 1963).

After this face was the stagnation and growth post-independence stage (1938-early 1964). The outbreak of pests and diseases led to a reduction in the production of

cocoa, especially in the Eastern region with the cultivation of cocoa moving further into the Brong Ahafo region. However, production picked up again after independence. This period is referred to as the stagnation and growth period. After Ghana gained independence, production increased steadily with the country reaching a record high in cocoa production of 430, 000 tons even though there was a decline in the world price of cocoa between 1960 and 1962. However, the government faced some challenges due to the fall in prices of cocoa on the world market, which resulted in the Cocoa Marketing Bord's (CMB) liquidity resources almost being exhausted. This, coupled with other challenges, led to a reduction in the producer prices of cocoa. The then government was overthrown during this same period in February 1966, leading to the major problems that were experienced in the cocoa sector (Kolavalli and Vigneri, 2011).

The downturn period in the production of cocoa then began around 1965 after the collapse of world cocoa prices (Gerard, & Ruf, 2013b). This period was between 1964 and 1982. About 20% of Ghana's cocoa was smuggled to Côte d'Ivoire between the period 1970 and 1980 (Bulír, 2002). Also, the ageing of cocoa trees coupled with diseases made the cocoa sector unattractive to cocoa farmers, thereby shifting from cocoa farming to food crop agriculture (Amanor, 2010). This led to the reduction in cocoa production to as low as 159, 000 tons by 1982/83. To revamp the sector, the government introduced new measures such as the establishment of the CMB and the introduction of bonuses to cocoa farmers. Also, producer prices of cocoa were increased, and this led to a new phase in the cocoa sector (Kolavalli and Vigneri, 2011). This is referred to as the recovery and second expansion phase (1983-2008).

The implementation of the Economic Recovery Programme in 1983 began the recovery of the cocoa sector. There was a component of the ERP known as the Cocoa Rehabilitation Project, which had a prime motive of reviving the cocoa sector. This saw

the introduction of a pricing mechanism in the cocoa sector which saw the increment in the farm prices of cocoa in Ghana to be higher than those paid in neighbouring countries in order to reduce the motivation to smuggle cocoa to neighbouring countries such as Ivory Coast. Farmers were also given some compensation for the removal of cocoa trees infected with swollen shoot disease and replacing them. This generally led to a high number of farms planting higher-yielding cocoa tree varieties. This saw a rebound in the production of cocoa to 400, 000 tons by the year 1996 with productivity moving from 210 to 404 kg/ha. However, cocoa production in Ghana gained much momentum in 2001. This is attributed to the high prices in the world market at the time and the introduction of some interventions by the Cocoa Marketing Board (COCOBOD) such as the cocoa mass spraying programme and fertilizer subsidies (Asamoah & Annan, 2012b). Others also attribute the growth during this period to the smuggling of cocoa from nearby countries such as Ivory Coast to Ghana which was estimated within the range of 120, 000 and 150, 000 tons in 2004 (Asamoah & Annan, 2012b). Cocoa prices have continued to increase over the period, although there are intermittent shortfalls. Currently, Ghana produces on the average of 900,000 tons of cocoa per annum with production reaching a million tonnes at the peak years.

According to McKay and Coulombe (2003), cocoa farming households experience improvements in their livelihoods compared to other food crop farmers. There is a clear indication of reduced poverty rates among cocoa farmers with household surveys conducted over the years indicating 23.9% reduction in poverty among cocoa farming households as at 2005, down from 60.1% in the 1990s (World Bank, 2007).

Production of Cocoa in Ghana

In Ghana, the cocoa plant grows well mainly around the tropical zone with the assistance of certain factors such as excessive rain rainfall, ample humidity(temperature) and high year-round sunshine (heat). The plant requires protection from the sun and wind during the production process. The fruits on the plant begin to sprout after 5 years. Cocoa pod production begins 10 years, and this continues until the plant reaches 40 years (World Cocoa Foundation). The farmland allocated for cocoa production must be prepared and cleared for production. The planting of seedlings take place after this process, and a cocoa tree is to be productive and strong for about 25 years or more. The maturity age at which a cocoa tree is first harvested does not influence production during the lifetime of the tree. Several factors such as the variety of cocoa tree, weather and maintenance have more effect on production during the life of the tree than the time of harvest. Cocoa seedlings are protected for it to thrive until they are 4 years old. The sunlight makes it possible for the lifespan of the cocoa tree to be increased to 100 years (Chocolate Manufacturers Association). The flowers of the cocoa tree grow nicely in a green colourful by the side all year round because of its photosynthetic process with the cocoa pods. The flowers develop a white or pink colour which tends to grow in large petals in the form of clusters. Pollination occurs by tiny insects called midges. However, only 2 percent of these clusters will develop to become a cocoa pod. It takes six months for the pods to reach maturity, which grows gradually from 16 cm to 50cm. Cocoa trees that are less than five years old will not produce seeds. Pods appear in red, green, yellow and purple form and contains 20 to 60 entrenched in a soft white pulp. As the cocoa leaves mature, they turn green and produces a deep taproot that is about 3 feet long. It also produces several horizontal feeder roots that spread out almost 20 feet in search of water and nutrients around the

tree. A cocoa tree grows about 50 feet tall before harvest (Garden guides 2016) Harvest takes place when seed pods turn yellow. The pods are chopped by the hand manually using a machete. The farmers do not pull the seed pods from the tree because the branches and limbs can be damaged considerably by the bark of the plant which has been ripped and this may cause a delay in future flower production. After the pods are harvested, the cocoa seeds are removed from the pod and made to undergo fermentation and drying. Pod husks are kept in a bag and often returned to the field to add nutrition to the soil for another production.

Internal and External Actors in Cocoa Production

The actors of the Ghanaian cocoa sector belong mainly to the public, formal and informal sectors of the economy. COCOBOD represents the public sector in terms of export activities and input supply. The formal sector comprises the LBCs, food retailers (cocoa made) and processors of cocoa beverages and is subject to government regulations. The informal sector consists of private dealers, small-scale businesses and self - employment businesses (Ghana Living Standard Survey Round 6 of Ghana Statistical Service 2016).

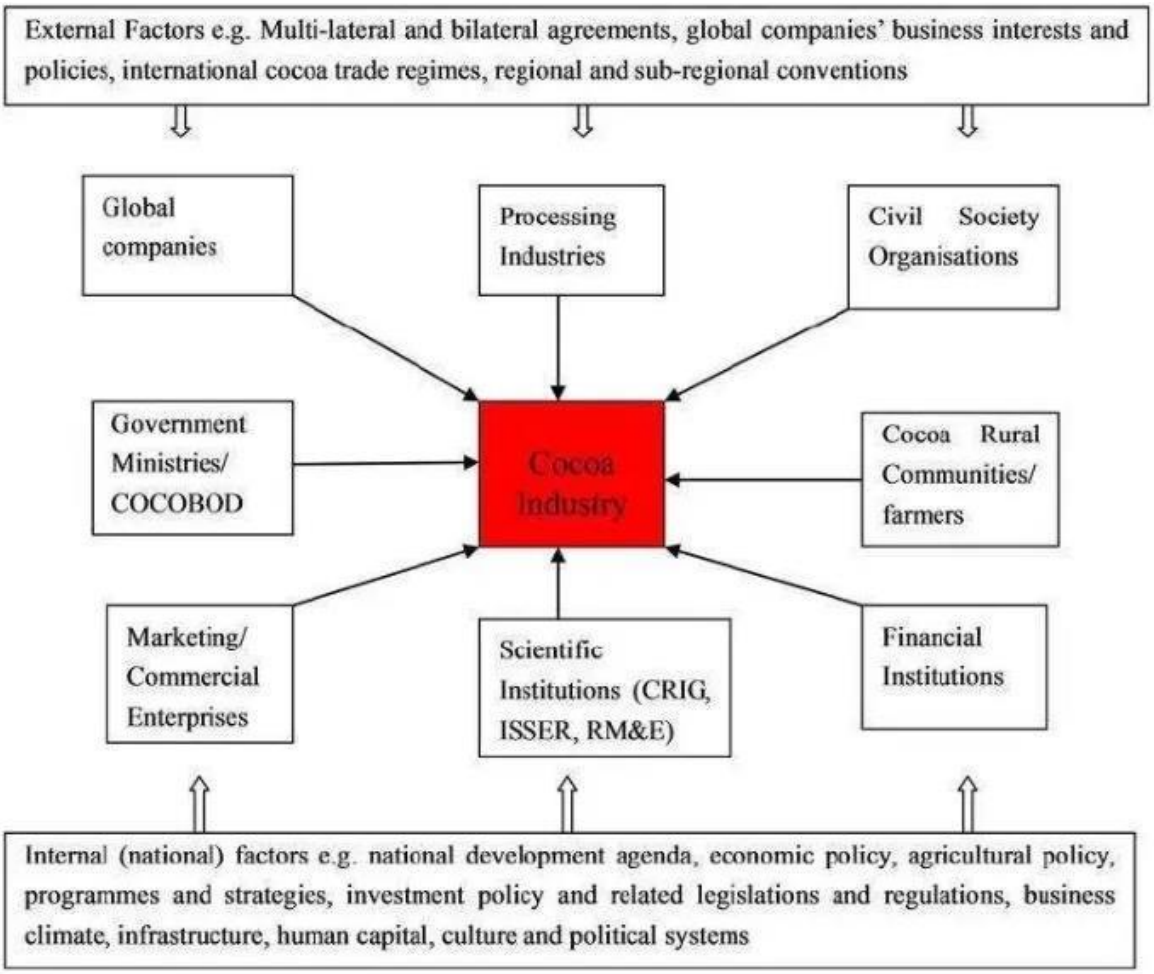

Figure 2: Diagram of the Cocoa Innovation System—Critical Actors and Influencing Factors.

Source: Adapted from Essegbey and Ofori-Gyamfi (2012).

Formal Actors

Licenced Buying Companies (LBCs)

COCOBOD provides Licenced Buying Companies (LBCs) with loans that come with a lower interest rate at the beginning of every cocoa season. Purposely, it is used to purchase cocoa from farmers. LBCs try to increase their market share by maximising the purchases of cocoa beans and increasing cocoa quantities as required (Williams, 2009; World Bank, 2013). District Managers and purchasing clients or clerks are employed from the local communities to arrange purchases and transporting

of cocoa from the villages to the warehouses of LBCs. Private transport service companies hired to transport sealed cocoa beans, non-recognized individuals also buy cocoa directly from the farmers and then sell it either to LBCs or elsewhere for higher returns (Mohammed et al., 2012). The LBCs tackles this task in a way that brings about the success of reaching the market objective of Ghana's cocoa industry. The Public Buying Companies (PBCs) form a sub-unit of the LBCs. Currently, PBC controls about 35% of cocoa beans mostly purchased in the country, and it remains a reputable enterprise to maintain its goodwill and was rewarded the topmost company in Ghana in 2011 including the financial institutions and industrial companies. Indisputably, the reformation that occurred in COCOBOD remains one of the key elements in the revitalization of the cocoa industry in Ghana.

Extension Services and Research

The Cocoa Health and Extension Division (CHED) a subsidiary of COCOBOD collaborates with the LBCs and other Non-Governmental Organisations (Lavenand Boomsma, 2012). It aims at increasing productivity and an annual yield of the crop by training farmers on the traditional method, modern (sustainable and chemical) methods, agronomic and forestry technologies of cocoa production. This actor also trains farmers on how to control weeds, pests and diseases that prevent the crop from yielding as expected (Aneani et al., 2012; World Bank,2013).

Research Institutions

The main centre of research for cocoa production in Ghana is the Cocoa Research Institute (CRIG). CRIG usually organizes research on various aspects such as varieties of cocoa species, pests and diseases, the establishment of cocoa on the field, socio-economic mechanism of cocoa cultivation and different ways of cocoa processing. Universities also conduct research on the cocoa industry.

The agriculture department of the Kwame Nkrumah University of Science and Technology (KNUST), University of Ghana, Soil Research Institute etc. However, the cocoa industry in Ghana is interested in researching for numerous international organizations; the Food and Agriculture Organization of the United Nations (FAO), The World Bank, The International Cocoa Organization, The World Cocoa Foundation as well as other international research institutions.

Informal Actors Retailers

The informal actors of the Ghanaian Cocoa Market are made up of the food retail environment and consumers. Mostly, retailing is in the form of a grocery shop and an open-air market, whereas 5% of the retail environment are supermarkets (MoFA and World Bank, 2008). Retailers offer varieties of locally produced and imported cocoa products such as chocolates, chocolate spreads, cookies, cakes, pomades, candies and cocoa powder for beverages. However, retailers are implicitly connected to the cocoa value chain as these products reflect a small fraction of their offerings.

Consumers

Cocoa is mostly consumed by the local market and Ghanaians who have a peculiar taste for cocoa- made products. The powdered beverages are less expensive and affordable; thus, making it the most popular and consumed cocoa product among local consumers. For many people, irrespective of their household income, prepare cocoa drinks for themselves and their household for breakfast. In contrast, cocoa made products such as pomade, chocolates, candies, cakes etc. are perceived as a luxury product because it is expensive for others. During holidays and special occasions, food retailers tend to increase the price of chocolates because of its high demand in the market.

International Actors

The main International actor of the Ghanaian cocoa market is The International Cocoa Organization (ICCO) which is established in London, which is made up of producing and consuming countries. In 1973, the first International Cocoa Agreement was put into effect and was negotiated in Geneva at the United Nations International Cocoa Conference. From then, the Ghana cocoa industry has been following up negotiations and conclusions on productive arrangements. The International Cocoa Organisation (ICCO) brings together all international players to decide on how to strategize and structure the cocoa market globally for the benefit of all players. In 2014, over 80% exporting acceded to the agreement after the agreement came into force the International Cocoa Agreement. The world cocoa production is represented by85% ICCO member countries and more than 60% of world cocoa consumption(icco-cooperation.org). International companies such as Cadbury (now Kraft Food) and Unilever, whose food industry depends mainly on cocoa play a role in stimulating the market.

The Alliance of Cocoa Producing Countries (ACOPAL) which produces 75% of the continues to operate in the Ghanaian cocoa industry since its formation in 1962. The organization has been able to ensure the sustainability of cocoa supply in the world market, and its main contribution is the facilitation of scientific and technical information regarding the production of cocoa in the respective countries.

The government's attention to set an emphasis on social responsibility and human rights issues have helped to develop the cocoa industry in Ghana. Civil society organizations (CSOs) such as the International Cocoa Initiative (ICI) deals with the issue of child labour and child rights, which is on the rise in various communities around the world. In Ghana, for instance, most of the household chores are undertaken by

children, and they make contributions to weed or help harvest cocoa pods on cocoa farms. ICI has made it possible for children not to be used as slaves and treated unfairly on cocoa farms. One may agree that all children, regardless of where they grow up, should not be denied the access to good education from basic to tertiary level especially as Ghana is already implementing the Free Compulsory Universal Basic Education (FCUBE). The partnership with the Ghana Government has established the National Programme for the Elimination of Child Labour (NPELC) in cocoa farming communities. This programme operates under the Ministry of Youth and employment with the support of COCOBOD. The board assisted in using rural FM radio stations to embark on intensive education and to address issues relating to abolishing child labour in cocoa-growing areas across the country.

Factors that affect Cocoa yield

Cocoa yield is affected by a lot of factors which includes on-farm management practices, climatic conditions and other external factors. However, for farmers to adopt a particular response to a perceived factor that affects cocoa production relies on a wide array of factors. This section considers a review of factors that affect cocoa yield in general while delving into perceptions held by farmers and how that affects their farm management practices.

Farm Management Practices that affect Cocoa Yield

Several factors affect cocoa yield in general. One of the critical factors is weed. Excess weeds compete with cocoa trees for nutrients and also, weeds around cocoa act as breeding grounds for pests and black pod diseases. Cocoa farmers are therefore advised to weed their farms regularly. According to Asamoah & Annan (2012b), farmers in Ghana control weeds on their farms on an average of 2.3 times a year. This is, however, contrary to findings by Aneani et al. (2007) who recorded 2 times in a year

as the number of times farmers weed their cocoa farms. According to a study by Aikpokpodion (2019b), 43.6% of farmers brushed their farms twice a year. This is contrary to the recommended 4 times a year of clearing weeds around cocoa given by the Cocoa Research Institute of Ghana (CRIG) (Asamoah, 2015). About 5.7% of cocoa farmers used weedicides, and the rest use the mechanical method of weed control (Aneani et al., 2007). Weedicide has implications for the environment which needs to be assessed in cocoa cultivation (Asamoah & Annan 2012b). Studies have shown that there is a positive relationship between the frequency of weeding and yield in crops (Aikpokpodion, 2019b).

The next farm management practice that affects cocoa production is the spraying against pests and diseases. In a study by Aneani and Ofori-Frimpong (2013), a negative relationship was revealed between cocoa spraying against fungi and cocoa yield. However, this result may be attributed to lack of education among farmers on the right application of these farm inputs leading to poor control of the black pod diseases (Asante et al., 2002). The black pod disease is prevalent in cocoa- growing regions, and they have the tendency of destroying more than half cocoa fruits in a farm usually in wet and humid periods (Asamoah & Annan, 2012b). According to Aneani et al. (2007), 29.3% of cocoa farmers do not spray to combat black pod disease. This is generally attributed to the difficult nature of spraying accompanied by the cost involved in the acquisition of chemicals for spraying with CRIG's guidelines requiring about 5-9 times spraying in a year (Asamoah, 2015). The reduction in spraying may also be attributed to the cocoa mass spraying exercise by the government, which many farmers rely on (Asamoah, 2015).

Cocoa productivity also depends mainly on the cocoa variety planted. According to a study by Edwin and Masters (2005), the planting of new cocoa varieties

resulted in an increase in the yield of cocoa by at least 42%. Ghana has seen the availability of cocoa hybrids for the past 35 years. Farmers generally prefer the hybrid cocoa seeds because the hybrids are considered to be early- bearing, high-yielding and produce pods with the ability to produce pods all year round. About 38.1% of farmers prefer seeds from pods acquired from their neighbours' farms, and these seeds usually are considered not good enough and have poor yields. About half of the farmers, on the other hand, acquire seeds from seed gardens (Aneani et al., 2007). Also, intercropping is another method that is considered as increasing productivity by providing a favourable environment (Li et al., 2009) and according to Tijani (2005), the relationship between cocoa varieties and yields is in the ability of the cocoa variety to resist pests and diseases.

Aikpokpodion, (2019b) posits that this is due to the nature of clearing the land where forests are cleared with the debris burnt, leading to the depletion of forests and soil nutrients. For instance, Wiredu, Mensah-Bonsu, Andah and Fosu (2010) also reported a significant inverse relationship between land productivity and land area under cocoa ($P < 0.05$) in Ghana. In a study to explain labour productivity of small-holder farmers in Nigeria, Okoye, Onyenweaku, Ukoha, Asumugha and Aniedu (2008) found farm size and household size to have a statistically significant negative relationship with labour productivity ($P < 0.05$).

Effects of Climate on Cocoa Production

Climate is an essential factor in agricultural productivity. The release of greenhouse gases into the atmosphere causes Climate Change. The accumulation of the greenhouse gases into the atmosphere leads to global warming. The related factors which cause changes in global climate such as temperature, precipitation and soil moisture, block the transmission of heat level.

The agriculture sector is mostly affected by the changing of climate (Cumhur and Malcolm, 2008). Cocoa is produced in countries in a belt between 10ºN and 10ºS of the Equator, where the climate is appropriate for growing cocoa trees. The natural habitat of the cocoa tree is in the lower storey of the evergreen rainforest, and climatic factors, particularly temperature and rainfall, are important in encouraging optimum growth. Cocoa plants respond well to relatively high temperatures, with a maximum annual average of 30 - 32ºC and a minimum average of 18 - 21ºC. Variations in the yield of cocoa trees from year to year are affected more by rainfall than by any other climatic factor (Adjei-Nsiah and Kermah, 2012). Therefore, rainfall should be plentiful and well distributed throughout the year.

Challenges in the Cocoa Sector

The cocoa sector, particularly in Ghana, is riddled with some challenges which affect overall cocoa production. This section highlights some of the challenges that affect the cocoa sector. The first thing to talk about is the availability and use of farm inputs for cocoa farmers. Generally, cocoa farming in Ghana is on a small-scale basis where between 90-95% of production is from smallholder farmers who cultivate averagely on 1 to 3 acres of land (German Initiative on Sustainable Cocoa, N.D.). What this means is that the majority of cocoa farmers have low incomes to be able to afford some farm inputs to improve cocoa yields.

Consequently, government programmes such as the cocoa mass spraying and the distribution of subsidized fertilizer to cocoa farmers are initiated to help farmers in terms of improving cocoa yields. However, these programmes usually are marred with some challenges which affect the possibility of reaching their targets. According to Awuah-Gyawu et al. (2015), inadequate monitoring of the distribution, coupled with corruption and politicization are significant factors that affect the acquisition and use

of these farm inputs. For instance, in 2014 the government's free fertilizer distribution was marred due to corrupt activities from the officials in charge of the distribution where farmers were either forced to pay before they get access to the fertilizers or show their political party cards before they could benefit (Mark, 2015).

Another challenge in the cocoa sector is the low education levels on the part of farmers and the unavailability of agricultural extension officers. Although farmers may have access to farm inputs such as fertilizers, pesticides, among others. Applying the right measurement on the farm becomes a problem. Looking at the number of cocoa farmers in the country, the numbers of Agric extension officers are woefully inadequate. Currently, the extension officer to farmer ratio in Ghana is 1:1850 (Ministry of Food and Agriculture, 2019). 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 and 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 (Awuah-Gyawu et al, 2015).

One major 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 guaranteed price it provides to the farmer. In guaranteeing a fixed price, COCOBOD effectively absorbs price challenges within the season from the farmer, 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 produce at the time of harvest while it only receives revenues post-shipment. When international prices rise, the margin between the price COCOBOD pays to the farmer and its international market sales price

increases. This is reversed when international prices fall, as the margin between the price paid to the farmer and the sales price decreases. 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 (Awuah-Gyawu et al, 2015). According to Awuah-Gyawu et al, (2015), the degree of fluctuation in prices is a major concern to the cocoa industry and either COCOBOD, License Buying Companies (LBCs) or farmers end up being cheated.

Inadequate credit facilities for cocoa farmers is another challenge in the cocoa industry. Small- scale cocoa farmers especially have a tough time obtaining 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 very little profit being achieved at the end of the day and de-motivate other cocoa farmers to expand the size of their farms for lack of funds (Laven, 2010).

The Ghana Cocoa Farmers Survey data between 2001/ 2002 and 2003/2004 revealed that six LBCs operating in 2001/2002 had gone out of business by 2003/2004 (Teal et. al., 2006). Teal et al (2006) conclude that the bankruptcy rate among LBCs is so high meaning that margins paid by the government to cocoa delivered by the LBCs to COCOBOD are woefully unsatisfactory.

Some 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 an LBC in order to maintain

its licence. With little or no flexibility, some LBCs feel quite overstretched. The cost of borrowing in Ghana is very expensive. The interest rate stands at 22.00% (Bank of Ghana, 2019). This, coupled with the time it takes to get funds locked up in the stock released to COCOBOD, makes it very challenging to do business as an LBC in Ghana. This amounts to the collapse of some LBCs.

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 declines after a period of about 20 years; what aggravates the problem is that cocoa production is also labour intensive. Farmers perceive that the cost of destroying 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.

The land tenure policy has also been a significant obstacle to the expansion of cocoa farms in Ghana. The chiefs in a traditional area own most 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 toils 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 the share of yield between landowner and farmer(s) respectively de- motivate the farmer who most times feel cheated looking at their level of investment into the production.

Cocoa plantations are susceptible to many kinds of diseases, which are said to destroy 30 - 40% of the world's cocoa production every year (Basso et al., 2012). Pests and diseases pose 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 to clear an old farm than to clear new forest lands (Kolavalli & Vigneri, 2011).

Many LBCs are unable to provide adequate storage facilities for farmers to store cocoa. Also, at the port, there are storage difficulties which contribute to traffic congestion at the port (Dankyi et al., 2007). Access to tractors to easily convey cocoa beans for drying on sheds pose serious challenges to many farmers. What aggravates the situation is 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 labour to carry the seeds from the farms in small quantities. The situation becomes unbearable, especially in the rainy season when a lot of seeds are destroyed for lack of these facilities.

Diffusion of Innovation Theory

The concept of diffusion was first studied by the French sociologist Gabriel Tarde in late 19th century and Dearing & Cox (2018d). The study of diffusion of innovations took off in the subfield of rural sociology in the midwestern United States in the 1920s and 1930s. Agriculture technology was advancing rapidly, and researchers started to examine how independent farmers were adopting hybrid seeds, equipment, and techniques (Dearing & Cox, 2018d). A study of the adoption of hybrid corn seed Dearing & Cox, (2018d) solidified the prior work on diffusion into a distinct paradigm that would be cited consistently in the future (Awuah-Gyawu et al, 2015)). Since its start in rural sociology, Diffusion of Innovations has been applied to numerous contexts, including medical sociology, communications, marketing, development studies, health promotion, organizational studies, knowledge management, conservation biology (Mascia et al., 2018) and complexity studies (Greenhalgh et al., 2018), with a particularly large impact on the use of medicines, medical techniques, and

health communications (Berwick, 2005). In organizational studies, its basic epidemiological or internal-influence form was formulated by H. Earl Pemberton (Pemberton, 1936) such as postage stamps and standardized school ethics codes.

In 1962, Everett Rogers, a professor of rural sociology, published his seminal work: Diffusion of Innovations. Rogers synthesized research from over 508 diffusion studies across the fields that initially influenced the theory: anthropology, early sociology, rural sociology, education, industrial sociology and medical sociology. Using his synthesis, Dearing & Cox, (2018d) produced a theory of the adoption of innovations among individuals and organizations. Diffusion of Innovations and Rogers' later books are among the most often cited in diffusion research. His methodologies are closely followed in recent diffusion research, even as the field has expanded into, and been influenced by, other methodological disciplines such as social network analysis and communication (Easley and Kleinberg, 2010). The main tenet of the theory bothers on how an idea or product becomes accepted and spreads in a population or social system over time. The acceptance of an idea or innovation means that people now begin to do things differently from what they previously did. Before a product or idea can be adopted, the person must perceive the product or idea is new or innovative (LaMorte, 2018).

According to the theory, within a social system, adoption does not occur simultaneously, but there is a process where some people are more likely to adopt the innovation. Research has established that there are varying characteristics that individuals exhibit which affect their adoption rate of an innovation or idea. Rogers established five adopter categories which have been explained below by LaMorte (2018).

- **Innovators** – innovators are willing to be the earliest people to adopt or try an idea/innovation. They are adventurous and attracted to new ideas. These groups of people in society take more risk and they are the first when it comes to developing new ideas. They need little or no motivation to be done to them to be appealed.
- **Early Adopters** – Opinion leaders fall in this category of adopters. This category of adopters normally enjoys leadership roles and welcomes the opportunity to change. They are already aware of the need to change and so are very comfortable adopting new ideas. Strategies to appeal to this population include how-to manuals and information sheets on implementation. They do not need information to convince them to change.
- **Early Majority** - These people are rarely leaders, but they do adopt new ideas before the average person. That said, they typically need to see evidence that the innovation works before they are willing to adopt it. Strategies to appeal to this population include success stories and evidence of the innovation's effectiveness.
- **Late Majority** - These people are sceptical of change and will only adopt an innovation after it has been tried by the majority. Strategies to appeal to this population include information on how many other people have tried the innovation and have adopted it successfully.
- **Laggards** - These people are bound by tradition and very conservative. They are very sceptical of change and are the hardest group to bring on board. Strategies to appeal to this population include statistics, fear appeals, and pressure from people in the other adopter groups.

The stages by which a person adopts an innovation, and whereby diffusion is accomplished, include awareness of the need for an innovation, decision to adopt (or reject) the innovation, initial use of the innovation to test it, and continued use of the innovation. There are five main factors that influence the adoption of an innovation, and each of these factors is at play to a different extent in the five adopter categories.

Relative Advantage - The degree to which an innovation is seen as better than the idea, programme, or product it replaces.

Compatibility - How consistent the innovation is with the values, experiences, and needs of the potential adopters.

Complexity - How difficult the innovation is to understand and/or use.

Trialability - The extent to which the innovation can be tested or experimented with before a commitment to adopt is made.

Observability - The extent to which the innovation provides tangible results.

Diffusion of innovations in the agricultural sector has occasionally been quite slow and difficult (Avolio et al., 2014). Some studies, according to Avolio et al. (2014) have sought to explain the adoption of technologies or innovations in farm management by throwing attention on the farm structure (Dedieu et al., 2009), knowledge and information diffusion (Zhang, Liu, Zhan, Lu, Zhang & Zhang, 2016b), and comprehensive approaches by considering the role of stakeholders and institution that make up the Agricultural Innovation System (Klerx et al., 2012). According to Zott, Amit & Massa, (2011), the creation of an idea is the main trigger of the innovation process, and before it reaches the market when it becomes true innovation. The process ends when the innovation is accepted as part of normal practices and procedure.

There is the assumption that before an innovation is accepted, the adopter should have economic freedom, knowledge in the market and the skills (Winter, 2006). Although these features may be directly or indirectly related to the characteristics of the innovator, nevertheless, innovation is also associated with some factors that are beyond the individual (Avolio et al., 2014; Zhang, Liu, Zhan, Lu, Zhang & Zhang, 2016b), identifies some of these factors which include uncertainty because of the fear of failure; the speed of action which refers to the possibility of the innovation being overrun by other innovations proposed by others; and the structural strength of the social, legal and cultural context in which it is introduced.

According to Asamoah (2015), a lot of small-scale cocoa farmers in Ghana are socio-culturally and economically restricted when it comes to the adoption of packaged technologies/innovations in cocoa farm management. Some of these factors include age, farmer goals, size of household, attitude, awareness and perception of the recommendations, inheritance systems as well as farmers' perception of the characteristics of the innovation. (Zhang, Liu, Zhan, Lu, Zhang & Zhang, 2016b) posits that "individual behaviour does not represent free will so much as choices within a constraint set and that it is the government and the private institutions, which establish and control the constraints."

The theory of innovation diffusion is, therefore, relevant in this particular study in some respects. In looking at the innovators, the study explores the leadership of farm-based organizations as having influence in the adoption and use of farm management practices. The factors responsible for the innovations and subsequent adoption by other farmers is also explored. In using the IDT as an analytical frame for the study, issues such as the sources of information and how farmers came to adopt and accept certain practices were explored. Also, the challenges in adopting certain practices are also

explored in the study. The availability of knowledge to farmers when it comes to farm management is very crucial. The study explores the information available to farmers on best practices, their perceptions on these management practices and whether they adopt or reject them. The reasons for accepting or rejecting are also investigated to establish whether these are related to individual (innovator) characteristics or external factors as established by the IDT.

Empirical Literature Review

Most empirical studies (Akmel et al., 2016; Benjamin et al., 2011; Folayan, 2010; Levai et al., 2015; Niemenaka et al., 2014; Quarmine et al., 2012) have focused on the different management practices and constraints that limit farmers from producing quality cocoa. They found out that farmers' management practices had a positive and significant relationship with cacao beans quality. Baffoe-Asare et al. (2013) found out that farmers' adoption of cocoa innovations is linked to their production capacity and farms. By contrast, this study jointly assesses the effect of farmers' behaviour in adopting Good Agricultural Practices (GAP) and Good Post Harvest Management Practices (GPHMP) simultaneously as a vital step to ensure the production of quality cocoa because the quality process is a prerequisite. Once an activity is not well carried out at the preceding stages of production, it becomes difficult to correct at successive stages in the production chain and affect the final quality of the bean available for sale.

Although many studies have been carried out on cocoa beans quality and safety standards in West Africa and other parts of the World, minimal research work has been done in Cameroon. Most studies in the Southwest region have applied the deductive approach to research, which is not very efficient in meeting up with cocoa beans quality and safety standards and has been based primarily on numerical evidence. This study will use an integrative approach to examine if a selection of factors is associated with

the farmers' behaviour for their different management practices. This study will formulate a structural model (SM) that shows the relationship between the farmers' management practices and their cocoa beans' quality. This model will show the present state of beans in the Southwest region of Cameroon, and the recommendations of the study will suggest what can be done to help farmers improve their quality of cocoa beans. The model will be relevant to all the cocoa sector stakeholders who have as their objectives to alleviate poverty and ensure food security. The findings will serve as a policy instrument to eliminate bad farm management practices and encourage result-oriented behavioural changes.

This study is based on the Theory of Planned Behavior (TPB) (Ajzen, 1991) as a critical theoretical framework to study cocoa farmers' general attitude in the adoption and implementation of sustainable farm management practices. The theory postulates that a persons' intention is an explanatory factor of their actual behaviour. Furthermore, a persons' intent is built from their perceived behavioural control (PBC), attitude and subjective norms. As such, the intention is the cognitive product of careful consideration of motivational, social and non-motivational factors that affect behaviour. An individual's perceived social pressure to carry out a particular behaviour is viewed as his subjective norm. The extent to which an individual has an unfavourable or a favourable evaluation of a behaviour is referred to as his attitude. Lastly, the extent to which a person can perform a behaviour is regarded as his PBC (Ajzen, Citation1991). Higher intentionality shows a higher willingness to carry out behaviour over which a person has actual control. Based on this reason, this modified theory is widely used in research.

The applicability of the TPB theory in different research contexts gives it strength over other psycho-social category theories (Ajzen, 2011; Meijer et al., 2015).

Its extensive usage in many studies has confirmed its importance and validity (Armitage & Conner, 2001; Godin & Kok, 1996). This study thus focuses on the TPB with a keen interest in the PBC. It also incorporates knowledge from other psycho-social theories such as the Theory of Reason of Action, which also explains that behavior can be captured by the intention of the individual to perform the behavior (I. F. M. Ajzen, 1980). However, TPB's main criticism is its prime prominence on psycho-social factors (Ajzen, Citation1985).

The study adopts the framework of the cacao beans quality equation proposed by Lima et al. (2011) to set up the research hypothesis. Figure 1 depicts the different management practices that farmers implement. The GAP that influences cocoa beans quality and safety standards include; planting improved plant varieties, proper soil management, spraying, frequent harvesting, Phytosanitary harvesting, pruning, adequate field sanitation and climate variability. The postharvest management process starts with pod breaking, followed by fermenting, drying and sorting (Lima et al., 2011). Richman (2010) carried out an investigation into the determinants of technical efficiency using a balanced longitudinal (panel) data on Ghanaian cocoa farmers for period of 2001 to 2006, and in this study, he concluded that both natural and socio-economic factors greatly affect cocoa production. Mubeteneh (2015) in a similar study concluded that changes in the production of cocoa result from a combination of changes in yields and changes in crops acreage as a result of the effect of both climatic (natural) and human factors. These studies are in line with the works of Oyekale and Oladele (2012); Kimengsi and Tosam (2013) and Teal, (2013) who affirm to the fact that physical as well as human factors affect cocoa production. They however attest to the fact that the magnitude and direction of influence of these factors vary depending on time and place.

Kyei et al., (2011) using primary data that was collected through the administration of questionnaires, analysed the basic determinants of technical efficiency, as well as the socio-economic variables that affect the performances of cocoa farmers in the Offinso district in Ghana. Their analysis showed that the model of the production functions was statistically significant at 0.00. This study concluded that the ability to properly use factors such as labour, capital and age of farms would lead to an increase in output.

Muketeet al (2016), in their study assessed the technical efficiency of smallholder cocoa farmers in the Meme division of the Southwest Region of Cameroon. Through descriptive statistics their results showed the technical efficiency to range between 0.11 and 0.99, with a mean technical efficiency of 0.86. They also observed access to credit and extension services to significantly influence technical efficiency in the Meme Division. Consequently, innovative institutional arrangements that enhance extension and farmer training, accompanied by improved access to credit could efficiently boost cocoa production in Meme and Cameroon in general.

Similarly, Mukete et al. (2018) examined the technical efficiency of small-scale farmers across Africa particularly Cameroon. Using published scientific literature, they observed that provision of appropriate technical skills and financial access would sustainably and enormously contribute to the growth of the cocoa sector, improve rural livelihoods, and achieve food security.

Technical efficiency as indicated by the concept of total factor productivity plays a vital role in the improvement of cocoa output. However, this is just one of the factors among many that affect cocoa production in the Southwest Region that this study has taken into consideration.

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Technical efficiency as indicated by the concept of total factor productivity plays a vital role on the improvement of cocoa output. However, this is just one of the factors among many that affect cocoa production in the Southwest Region that this study has taken into consideration. Aneani, et al (2011) analyzed the extent and determinants of crop diversification by cocoa farmers in Ghana. Using multinomial regression analysis, the study found that age of cocoa farm and access to credit were statistically significant ($P< 0.05$) determinants of cocoa farming diversification. Thus, the study recommended that cocoa production can be improved and sustained by convincing farmers to replant old cocoa farms, modernise traditional cocoa farming practices and improve access to credit facilities for farmers.

Ojonimi et al. (2012) assessed the profitability of cocoa farms in Nigeria's largest cocoa producing state and ascertained their profitability determinants. The data was analysed using descriptive statistics, budgetary analysis and OLS multiple regression models, showed that cocoa production is profitable with mean profit of US$10342.93. The determinants were labour, capital, seedlings planted and household size. The study recommends farmers‟ training through agricultural agencies and the provision of access to credit in order to guarantee sustainable production of cocoa in Nigeria. Relatedly Fadipe et al., (2012) examined the economics of cocoa production in Oyo state, Nigeria. Descriptive statistics, farm budget analysis, profitability and

efficiency ratios and ordinary least square regression were the major analytical tools employed for the study. Results of the analysis showed that a net return of N37, 705.69 per hectare was made in a production season and the profitability and efficiency ratios were 2.33 and 3.33 respectively implying that cocoa production in the study area is profitable and efficient. The study identified farm size, access to credit, chemical inputs and farm age as factors that significantly affect cocoa production in the study area. Thus, it therefore recommends the improvement of farm size, making credits available at no or little interest and provision of basic amenities in the rural areas.

Forgha and Tosam (2013) assessed the socio-economic determinants of cocoa production in the Meme Division of the Southwest Region of Cameroon. With the use of the Generalized Method of Moments (GMM) and Trend Analysis the study revealed that capital, labour and price had a positive significant relationship on the output of cocoa while political influence and gender insignificantly affect output of cocoa. Based on the findings, the study concluded that the observed socio-economic variables affect cocoa production but the degree and direction to which each variable affects output varies.

In a similar study Effah et al, (2017) investigated the determinants of cocoa production in the Ashanti region in Ghana. With Ordinary Least Squares (OLS) estimates from a Cobb-Douglas production function, the study found that the total revenue and hired labour variables had significant influence on cocoa production. Both variables were significant at 1%. On the other hand, the number of times of mass spraying and farm size variables were statistically insignificant. These results were contrary to those of Dorward (1999); Oyekale and Oladele (2012) and Ogunsola and Oyekale (2013) who affirm the significant influence of spraying and farm size on cocoa production.

Conceptual Framework

Based on the literature and theoretical review above, the conceptual framework of the study is formulated. As shown in Figure 2.2, farmers' perception culminates into whether they perceive certain natural or anthropogenic factors as affecting cocoa yield. These perceptions are, in effect, influenced by external and internal factors. Empirical research has focused on a wide range of factors such as information, profits (farm income and off-farm income), land tenure, farm size, experience, and education. Certain factors, studied in isolation, show a clear and positive effect on adoption of farm management practices; these include access to credible information, government subsidies, environmental consciousness, and profitability of practices (Liu et al., 2018). External factors that may affect the perception of a cocoa farmer include the availability of extension services, farm-based associations the farmer is part of, as well as information services. While these external and internal factors may influence perception, they also affect the reactions farmers may take in light of the perceptions held. Aside from the demographic factors, other external factors

also affect the adoption of farm management practices. The external and internal factors interact to influence a farmer's choice and practice of farm management activity. The practice of the farm management activity then affects the yield of the cocoa. Building on the IDT, the study examines how farmers decision to adopt particular management practices (innovations) are influenced by both the external and internal factors. It examines whether the trends in cocoa yield are influenced by these internal and external factors that affect farmers' decision to adopt certain management practices (innovations). The conceptual framework also talks about the challenges to the adoption of farm management practices which include financial challenges, education or political factors.

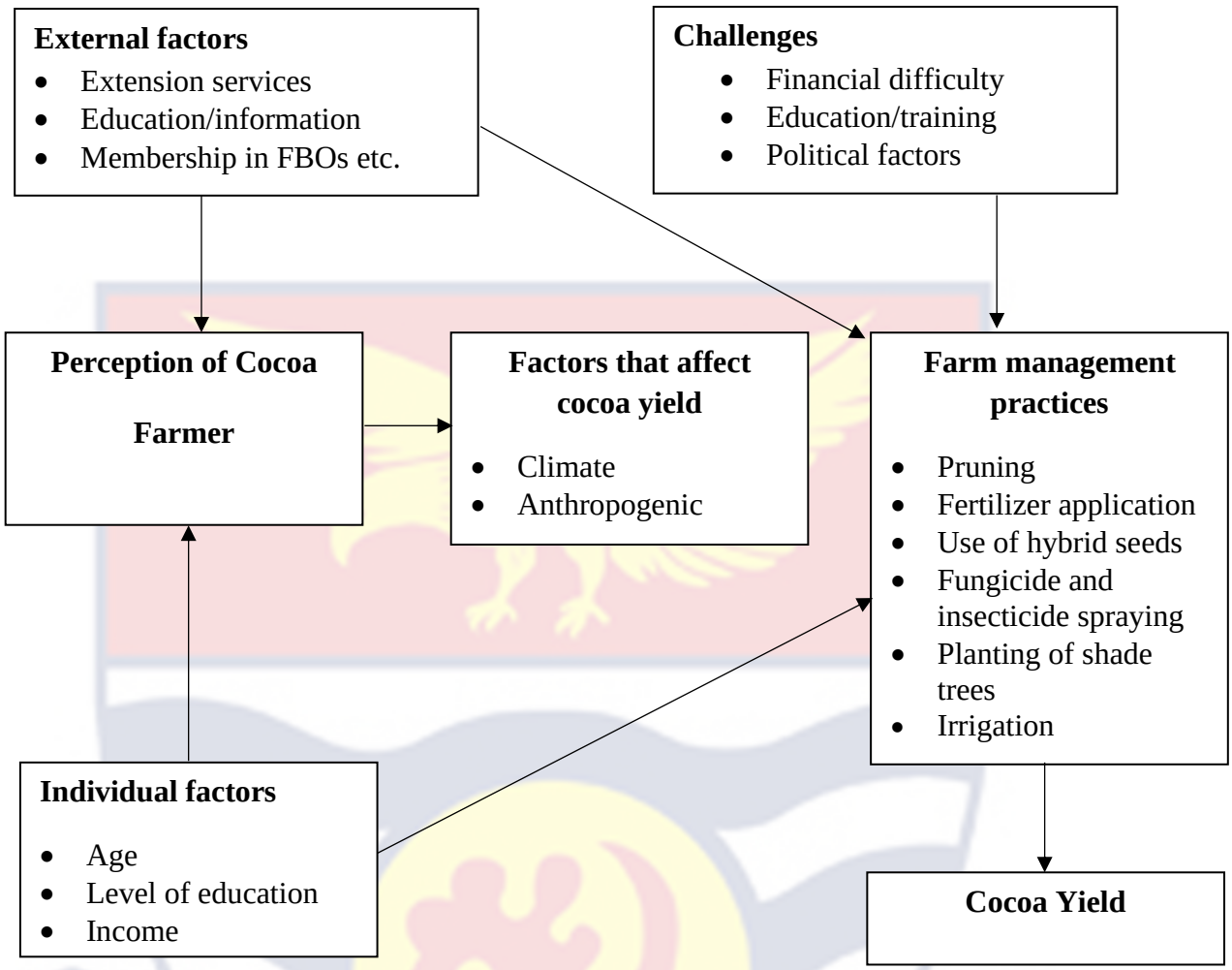

Figure 3: A conceptual Framework showing the Interactions between Perceptions, Farm Management Practices and Cocoa Yield

Source: Author's own construct, 2023

Chapter Summary

This chapter basically discussed the literature review component of the study where issues such as the overview of cocoa production in Ghana, the factors that affect cocoa yield and the challenges in the cocoa sector were discussed. The theories used in the study and the conceptual framework are also discussed in this chapter.

CHAPTER THREE

METHODOLOGY

Introduction

This chapter is in two parts. The first part discusses the study area (Western North Region) where information is provided on the location, demographic characteristics and physical features. These issues were considered because they are related to cocoa growth directly or indirectly. The second part of the chapter talks about the methods used in achieving the study objectives, where the research design, sample size determination and sampling techniques, as well as the data analysis methods, among others are discussed.

Research Design

This study adopts a multiple case study where 5 communities in the Western North Region were randomly selected. A case study is a method that encompasses the in-depth investigation of a precise bounded system, applying multiple forms of data collection to systematically gather information on how the system operates or functions. This bounded system may be as simple as a single individual or group, or as complex as a neighbourhood, organization, or culture. It may also include programs, events, or activity. Multiple-case design, or collective case design, refers to case study research in which several instrumental confined cases are selected to develop a more in- depth understanding of the phenomena than a single case can provide (Chmiliar, 2010). This research methodology provides more extensive descriptions and explanations of the phenomenon or issue. Cross case examination is employed to develop an in-depth understanding of a phenomenon or issue that may yield increased generalizability. Cause-and-effect relationships may be identified, and examination of the similarities and differences across cases may strengthen theory (Chmiliar, 2010). However, the case

study design has been criticised as causally deterministic, non-replicable, subjective in its conclusions, absence of generalizable conclusions, bias case selection and lack of empirical clout (Creswell, 2014). In dealing with this criticism, the study outlined a step by step methodology that can be replicated by any other researchers who wish to replicate the study. Also, the critique of the multiple case study being subjective in its conclusions does not hold for this study as all the conclusions emanated from the outcome of the study. Therefore, although the multiple case study has some challenges, its usage did not affect the conduct of the study nor the results produced. According to Zainal (2007), a case study approach enables researchers to assess data from the micro level and becomes the practical solution in instances where a big sample population is involved. Adopting a multiple case study approach in investigating the determinants of cocoa production provides an opportunity to assess community- specific practices and how that affects cocoa yield. This creates the opportunity of highlighting any possible variations among different communities and how that can affect cocoa production. Although the study employs a cross-sectional data collection approach, records of cocoa produced over a five-year period were sought from farmers in order to understand the trend in cocoa production.

Research Strategy

This study employed the mixed-method approach in the collection of data. A mixed-method employs both the quantitative and qualitative approach in the collection of data. According to Creswell (2009), the mixed method has the advantage of complementing either the quantitative or qualitative method with one addressing the shortfalls experienced in the other. The mixed-method also ensures the cross-validation of each strategy around a common reference (Teye, 2012). The quantitative data in this study helped to make generalizations by performing statistical analysis such as chi-

square and multinomial regression tests which enabled the assessment of relationships between variables and determinants of cocoa production, respectively. The qualitative data, on the other hand, give room for explaining some of the responses from the quantitative data.

Sources of Data

Data for the study were obtained from two main sources; the primary and the secondary source. The Primary data were acquired by the administration of questionnaires, and the organization of in-depth-interviews and Focus Group Discussions (FGDs). The primary data probed into the farm management practices and perceptions from the farmer point of view that determines cocoa production in the Western North Region. In obtaining the primary data, two main research instruments were used. These include semi-structured questionnaires and interview guides.

The secondary data obtained from journal articles, public records, both print and electronic media as well as books. The secondary data provided background information and some data that aided the conduct of the study.

Semi-structured Questionnaire

The questionnaires were used to collect mostly quantitative data with little qualitative data. Information from farmers such as their bio-data, the size of cocoa farm holdings, the record of cocoa production as well as the practices they are engaged in will be sought using the questionnaire. Also, data on perceptions on factors that influence cocoa yield and challenges farmers encounter were obtained using the questionnaires as instruments.

Interview Guides

Interview guides were used primarily for the qualitative data. This formed the main instrument for the one on one interviews with chief farmers and other officials as well as for FGDs. The interview guides contained questions such as the reasons for performing certain farm practices and the impacts on cocoa yields. Additional questions bothered on challenges farmers go through and the factors that determine cocoa production.

Sample Size Determination

Different sample sizes were obtained for the qualitative and quantitative data. For the quantitative data, the employs the Yamane formula for determining sample size to select the respondents for the questionnaire survey. According to the 2010 population and housing census, the total number of farmers in the Western North Region stands at 12, 447 (GSS, 2014). This population was used as the sampling population since cocoa is the commonest cultivated crop in the forest regions of Ghana. Using the Yamane formula, the sample size obtained is 387 farmers (see formula below). However, considering the fact that some of the farmers might not be cocoa farmers, this sample was reduced to 200 for the purposes of the study. The reduction in the number was also informed by logistics and time constraints.

$$n = \frac{N}{1+N\,(e)^{2}}$$

n= sample size

N= total study population (12447) 1= constant

e= confidential level (0.05). Source: Yamane, 1973.

In each of the five communities selected for this study (Figure 3.1), 40 questionnaires were administered.

With the qualitative data, the study targeted chief cocoa farmers for the in-depth interviews. Also, agricultural extension officers were targeted for interviews. FGDs were organized in each community to solicit the views of farmers. Table 3.1 provides a summary of the total number of people that were sampled for the study in each community.

Table 1: Sample Size and Target Population for Interviews and FGDs

Target group	
Chief farmers	5
Extension officers	2
FGD participants	5 in each community

Source: Field data, 2023

Sampling Techniques

The multi-stage sampling method was used in selecting respondents for the questionnaire survey. Multi-stage sampling is a more complex form of cluster sampling which contains two or more stages in sample selection. In multi-stage sampling, large clusters of the population are separated into smaller clusters in numerous steps in order to make primary data collection more practicable. The multi-stage sampling technique has been criticised for a high level of subjectivity when used. Also, the research findings from this sampling technique can never be 100% representative of the population, and the presence of group-level information is also required when this method is adopted. However, aside from these critiques, the multi-stage sampling technique is advantageous due to its effectiveness in primary data collection from a geographically dispersed population when face-to-face contact is required. Also, it is cost-effective,

and there is a high level of flexibility when this method is employed (Research Methodology, n.d.). This method was adopted in this study because the respondents formed part of a group of farmers and therefore steps needed to be taken to only identify these respondents (cocoa farmers) from the bigger sample frame of all farmers.

The first stage of the sampling involved the selection of the communities. Through a preliminary study of the communities and making reference to the 2014 Western North Regional analytical report by the GSS the researcher observed that all the communities in Western North Region were similar in terms of the socio-economic characteristics. Therefore, in order to ensure equity in terms of rural-urban representation, three rural communities were randomly sampled from the 18 rural communities in the district and added to the two urban communities making the study communities five in all. Random sampling denotes a diversity of selection techniques in which sample members are carefully chosen by chance, but with a known probability of selection. Most social science, business, and agricultural surveys rely on random sampling techniques for the selection of survey participants or sample units, where the sample units may be persons, establishments, land points, or other units for analysis. Random sampling is a critical element of the overall survey research design (Ballou and Lavrakas, 2008). The simple random sampling is advantageous because it includes ease of use and accuracy of representation. Also, selecting subjects completely at random from the larger population also yields a sample that is representative of the group being studied (Depersio, 2018). The simple random sampling was therefore considered the best for the study since all the communities had an equal chance of being selected. The communities selected are Ahibenso, Cholicholi, Akontombra ,Kojokrom and Bodi, with Akontombra and Bodi being the urban communities. The second stage involved the selection of the respondents for the questionnaire survey. Each of the

communities was assigned a sample size of 40. Cluster sampling was used at the community level, where each community was divided into four clusters, and 10 questionnaires were administered in each cluster. The communities were divided into clusters because the study sought to consider respondents from all geographical parts of the communities to ensure balanced representation. Convenient sampling was then used in getting respondents from each of the clusters. Convenience sampling is a type of nonprobability sampling in which people are sampled simply because they are "convenient" sources of data for researchers (Lavrakas, 2008). Upon arriving in the various clusters, the researcher enquires from any household he enters whether the household head is a cocoa farmer. All the cocoa farmers, upon their agreement to participate in the study, were interviewed. One of the advantages of convenience sampling is that data collection can be facilitated in a short duration of time and considering the time constraints of the thesis is was appropriate to use.

With respect to the selection of participants for the FGDs consultations were made with the community chief farmers and assemblymen to gather a group of up to 10 farmers for the FGDs. Two extension officers were selected from the district level purposively as well as the chief farmer of each community for the interviews. These participants were selected because they were deemed to have good knowledge of the farm management practices and its associated impacts on cocoa yield.

Data Analysis

The quantitative data were analysed with the help of the SPSS software version 22. The data were first coded and entered with the help of the software. Later, descriptive statistics, such as tables and graphs, were generated. Also, cross-tabulations were conducted. These were done in accordance with the study objectives.

The qualitative data were analysed by first transcribing the interviews and FGDs into word documents. With the help of the NVivo software version 12, various themes were generated from the transcripts. Direct quotes were used to support some of the quantitative results and discussion.

Profile of Study Area

The Western North Region is one of the six (6) new Regions of Ghana created in 2019.The main reason for the creation of the region is the difficulty of the people of Sefwi getting essential government developmental projects or services from the former Regional Capital i.e. Sekondi-Takoradi. Therefore, the six paramount chiefs in the present day, the Western North Region became responsive to the calls of their subjects and which consequently led to the creation of the Western North Region.

Administrative Divisions

The political administration of the Region is through the local government system. The Region is divided into nine (9) Municipal and District Assemblies made up of three (3) Municipalities and six (6) Districts (MDAs). These MDAs report to the Western North Regional Coordinating Council. Each Municipal/District Assembly is administered by a Chief Executive, representing the Central Government. The Municipal/District Assemblies in the Region are; Sefwi Wiawso Municipal Assembly with Sefwi Wiawso as its administrative capital, Bibiani-Anhwiaso-Bekwai Municipal Assembly with Bibiani as its administrative capital and Aowin Municipal Assembly with Enchi as its administrative capital. Sefwi Akontombra District Assembly with Akontombra as its administrative capital, Suaman District Assembly with Didieso as its administrative capital, and Bodi District Assembly with Bodi as its administrative capital. The rest are Juaboso District Assembly with Juaboso as its administrative

capital, Bia West with Essam as its administrative capital and Bia East Districts with Adabokrom as its administrative capital. (http://ghana.gov.gh/index.php/governance

The Region is bounded by La Cote D'ivoire on the West, the Central Region in the South-East, and the Ashanti, Ahafo, and Bono Regions in the North and Western Region to South-West

Figure 4 Map of Western North in National and Regional Context

Source: Ministry of Local Government and Rural Development, 2019

Population

According to Ghana Statistical Service, the projected population for Western North Region is 949,094 with 2.9% Annual Population Change from 2010 to 2020 (Ghana Statistical Service Web)

Climate (Temperature and Rainfall)

The Western North Region, falls within the tropical rainforest climatic zone with high temperatures throughout the year between 25^0C and 30^0C and moderate to

heavy rainfall pattern between 1200mm and 1780mm per annum. It comes with double maxima characteristics in June-July and September-October as its peaks. Humidity is relatively high, which is about 90% at night falling to 75% during the day.

The rainfall pattern is unique and suitable for agricultural activities in the Region. It has two long wet seasons separated by relatively short dry seasons. The dry season is marked by relatively low humidity with hazy conditions occurring from November to January. The Region experiences fewer or no bush fire outbreaks due to the relatively short dry season.

The Region often experiences concentrated downpours up to 178mm rainfall in a day, which often causes widespread flooding at some settlements due to the nature of the soil.

The implication of the climate of the Region is that it is suitable for the growing of various crops particularly both cash and food crops. This is the reason why the Region is one of the leading producers of the cash crop like cocoa in Ghana.

Vegetation

The Region's vegetation is of the moist semi-deciduous (equatorial rain forest) type. The forest vegetation is made up of many different tree species including wawa (Triplochiton selerexylon), mahogany (Khaya invorensis), esa (Celtis), ofram (Terminalia superba), edinam (Entandro phragma ivorensio), onyina (Ceiba petandra), kyenkyen (Antiaris Africana) and odum (Milicia exelsa), Sapele etc. Hence, the Region is a suitable location for the establishment of timber firms. There are a number of forest reserves dotted in the Region, however, there is a high degree of depletion of the original forest due to improper farming practices, logging and illegal mining activities. Therefore, most of them have become secondary forests.

Relief and Drainage

Most part of the Region is generally undulating and lies between 152.4m – 660m above sea level. The highest point is also the highest in the Western North Region at Attanyamekrom (Adiembra), near Sefwi Bekwai which is 660m. Other highest peaks are the Krokoa peak which is 510m above sea level and lies roughly to the South-West of Sefwi Wiawso.

Three of the major rivers in the country are found in the Western North Region. They are Rivers Ankobra, Bia and Tano. The Region is also endowed with some streams which serve as tributaries of these major rivers. These are Krodua, Atronsu, Subriso, Kroseini, Suraw, Chira and Akataso Suhien, Kunuma, Disue etc.

Chapter Summary

This chapter discussed the study area used for the study and the methodology used in arriving at the study's objectives. The socio-demographic characteristics of the study area are discussed as well as the physical characteristics. In terms of the methodology, the research design, strategy, the sources of data and the method used in analysing the data are discussed.

CHAPTER FOUR

PRESENTATION OF DATA, ANALYSIS AND DISCUSSION

Introduction

This chapter presents the results of the study. This is done according to the study's objectives. However, the first section is dedicated to providing results on the demographic background of the respondents used for the questionnaire survey. Results were shown for demographic characteristics such as gender, age, level of education, income, marital status, farm size, among others. This is followed by the main objectives which are the trends in cocoa production among respondents, perceptions of farmers on factors that influence cocoa production, farm management practices that influence cocoa production and the challenges associated with farm management practices.

Demographic Characteristics of Respondents

The first demographic factor that was considered is the gender of respondents. The data revealed that the majority of the respondents are males while the remaining are females. At the community level, however, this distribution was not homogenous. Bodi had the highest majority of male respondents followed by Akontombra. Cholicholi had the lowest difference between males and females (Table 2). With age, the highest category of respondents was those between the ages of 31 and 40, followed by those in the 41-50 years category. The least category of respondents was within the 20-30-year group. This however varied among the individual communities. With the exception of Ahibenso, all the communities visited had the least category of respondents belonging to the 20-30 years category (Table 2).

Majority of the respondents have JHS/Middle school as their highest level of education. This is homogenous in all the communities with the exception of Ahibenso and Cholicholi where those belonging to the JHS/Middle school category had 40.8%

and 45% representation respectively (Table 2). A large majority of the respondents were married. This figure was quite similar in all the communities with the exception of Kojokrom, where although the majority of the respondents were married it was a percentage compared to the other communities. The least category of respondents was those who have been separated (Table 2).

The highest proportion of respondents had an income fewer than 200 cedis per month. This is followed by those with income levels between 201 and 500 per month. The least proportion of the respondents had an average monthly income of 1% (Table 2). Christians dominated in all the communities followed by Muslims who were below 10%. Those who belonged to other religions formed the least about 3% representation (Table 2).

Majority of the respondents belonged to a farmer organization. In Ahibenso, half of the respondents belonged to a farmer organization whilst Kojokrom had the highest majority of two- thirds of farmers belonging to a farmer organization (Table 2). The highest proportion of respondents belonged to a household with a membership of 4-6. This is followed by 29.1% of the respondents belonging to a household with membership from 7-10. The least proportion of respondents belonged to a household with membership above 10. However, this distribution varied among the various study communities. For instance, whilst Cholicholi and Kojokrom had a majority of respondents belonging to a household with members 4-6, the other communities were all in the minority (Table 2).

When it comes to farm size, the highest proportion of respondents had between 3 and 7 acres. This is followed by those with farm size between 10 and 20 acres. The least category of respondents had a farm size above 20 acres. Bodi had a majority of

respondents having a farm size between 3 and 7 acres which is the highest percentage in all the communities (Table 2).

Table 2: Demographic characteristics of respondents

Description	Total		Bodi		Akontombra		Kojokrom		Ahibenso		Cholicholi	
	Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
	RELIGION											
Christian	167	87.0	43	87.8	49	90.7	16	84.2	26	83.9	33	84.6
Muslim	19	9.9	3	6.1	5	9.3	10	10.5	3	9.7	6	15.4
No Religion	6	3.1	3	6.1	0	0	1	5.0	2	6.4	0	0
Total	200	**100**	49	**100**	54	**100**	27	**100**	31	**100**	39	**100**
	MEMBERSHIP OF COCOA FARMER ORGANISATION											
Yes	101	50.5	30	42.9	18	39.3	12	50.0	16	55.2	21	67.7
No	99	49.5	40	57.1	28	60.8	12	50.0	13	44.8	10	32.3
Total	200	**100**	70	**100**	46	**100**	24	**100**	29	**100**	31	**100**
	HOUSEHOLD SIZE											
1 - 3	27	13.5	15	30.6	9	15.3	5	21.7	2	6.7	15	35.7
4 - 6	87	43.5	0	0	26	40.1	8	34.7	16	53.3	22	52.4
7 - 10	57	28.5	23	46.9	19	32.2	6	26.1	7	23.3	0	0
Above 10	29	14.5	11	22.4	8	13.5	4	17.3	5	16.7	5	11.9
Total	200	**100**	49	**100**	59	**100**	23	**100**	30	**100**	42	**100**
	TOTAL SIZE OF COCOA FARM											
1 - 3	32	16.0	9	18.4	11	18.3	2	10.0	4	12.9	6	15.0
3 – 7	89	44.5	25	51.0	31	51.7	13	65.0	8	25.8	12	30.0
7 – 10	25	12.5	8	16.3	5	8.3	2	10.0	5	16.1	5	12.5
10 – 20	52	26.0	7	14.3	13	21.7	3	15.0	12	38.7	17	42.5
Above 20	2	1.0	0	0	0	0	0	10	2	6.5	0	0
Total	200	**100**	49	**100**	60	**100**	20	**100**	31	**100**	40	100
	GENDER											
Male	126	63.0	29	59.2	43	71.7	12	60.0	21	67.7	21	52.5
Female	74	37.0	20	40.8	17	28.3	8	40.0	10	32.3	19	47.5

Total	200	100	49	100	60	100	20	100	31	100	40	100
	AGE											
20 – 30	13	6.5	6	12.2	3	5.0	0	0	2	6.5	2	5.1
31 – 40	50	29.6	15	30.6	22	36.7	9	45.0	5	16.1	8	20.5
41 – 50	57	28.6	12	24.5	12	20.0	3	15.0	14	45.2	16	41.0
51 – 60	33	16.6	2	4.1	15	25.0	3	15.0	7	22.6	6	15.4
Above 60	37	18.6	14	28.6	8	13.3	5	25.0	3	9.7	7	17.9
	LEVEL OF EDUCATION											
No formal Education	46	23.0	18	36.7	10	16.7	5	25.0	5	16.1	8	20.0
Primary	37	18.5	5	10.2	16	26.7	5	25.0	5	16.1	6	15.0
JHS/Middle School	105	52.5	20	40.8	31	51.7	9	45.0	19	61.3	26	65.0
SS/SHS/Vocational/ Technical	9	4.5	4	8.2	3	5.0	1	5.0	1	3.2	0	0
Tertiary	3	1.5	2	4.1	0	0	0	0.0	1	3.2	0	0
Total	**200**	100	49	100	60	100	20	100	31	100	40	100
	MARITAL STATUS											
Married	147	73.5	41	83.7	42	70.00	15	75.0	26	83.9	23	57.5
Single	28	14.0	4	8.2	7	11.7	2	10.0	3	9.7	12	30.0
Divorced	7	3.5	0	0	3	5.0	1	5.0	2	6.5	1	2.5
Separated	1	0.5	0	0	1	1.7	0	0.0	0	0.0	4	10.0
Widowed	17	8.5	4	8.2	7	11.7	2	10.0	0	0.0	0	0
Total	**200**	100	49	100	60	100	20	100	31	100	40	100
	INCOME											
Below 200	135	68.9	41	83.7	32	55.2	15	78.9	26	83.9	21	53.8
201 – 500	51	26.0	6	12.2	25	43.1	3	15.8	4	12.9	13	33.3
501 – 800	2	1.0	0	0	1	1.7	1	5.5	1	3.2	2	5.1
801 – 1000	5	2.6	2	4.1	0	0	0	0	0	0	0	0.0
Above 1000	7	1.5	0	0	0	0	0	0	0	0	3	7.7
Total	200	100	49	100	58	100	19	100	31	100	39	100.0

Source: Field Work, 2023

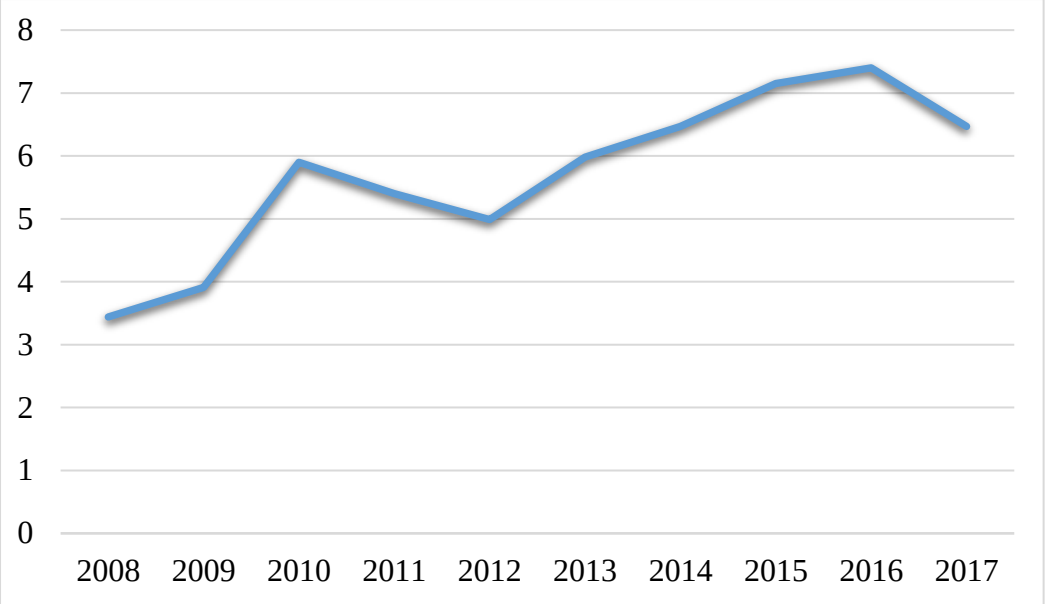

Figure 5: Record of Cocoa Production in the Study Communities

Source: Fieldwork, 2023

Ahibenso, Cholicholi, Akontombra, Kojokrom and Bodi, with Akontombra and Bodi.

Some respondents attributed the dip in cocoa yield to political reasons. To buttress this point, a respondent in Kojokrom said the following.

... in 2009 when Attah Mills became president, they changed the person in charge of the mass spraying exercise in this community and because in our house we support NPP can you believe my cocoa farm of about 9 acres they used only 20 minutes to finish spraying…

it was even better if they had not sprayed…[a 52-year-old man during an FGD in Kojokrom].

Also, a cross tabulation between the communities and average cocoa output per year was run. It emerged that Ahibenso had the leading outpit from 2013 to 2017. Also, in 2009 and 2010 Kojokrom had the highest output. Cholicholi also had quite a high output in most of the years apart from Ahimbenso. This is shown in Figure 4.3

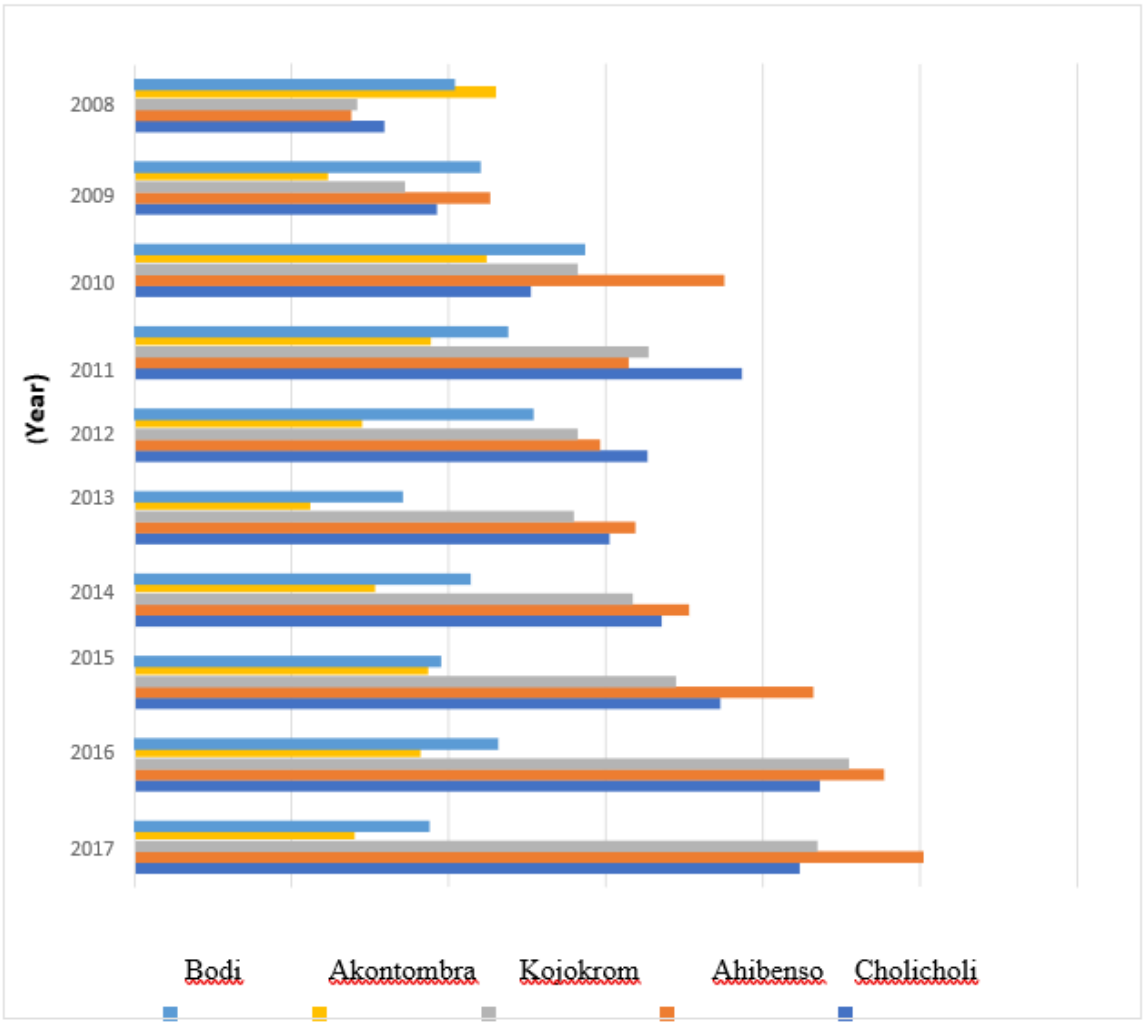

Figure 6 Cross Tabulation between Cocoa Yield and the Study Communities

Source: Field Study, 2023

Also, the study looked at the relationship between age and cocoa production. The data shows that farmers who were above the age of 60 years have more cocoa output per year compares to farmers who were younger than 60 years. For instance, those who were above 60 produced an average of 9 bags in the whole year which is higher than the output of any other age category. The only instance where those above 60 years did not produce the highest number of bags were in 2008 and 2010, where the highest output came from those between the ages of 50 and 60. This is shown in table 3 below.

Table 3: Cross-Tabulation between the Age of Farmers and Cocoa Production Over a Ten-year Period

Ages	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
20-30										
31-40	8.0	8.2	7.0	6.0	4.8	5.1	5.8	6.2	3.7	3.1
41-50	5.2	5.9	5.2	4.8	4.0	4.9	5.5	5.9	4.2	3.2
51-60	8.3	8.0	7.2	6.7	6.2	5.8	6.1	6.5	3.7	4.8
Above 60	9.1	9.2	7.4	7.3	6.5	7.2	7.7	6.1	5.1	4.2

Source: Field Study, 2023

Level of Education of Farmer

The next variable that was looked at with respect to cocoa output by farmers was the level of education. Also, looking at the level of education the data revealed that on the average, those who have educational background up to the SSS/SHS ended up producing the highest number of output when it comes to cocoa production with about 9.60 bags. This is followed by those with no formal education who produced about 6.1 bags on the average over the 10-year period. Those with primary education followed with 6.03 bags, followed by those with JHS education. However, the least on the average produced was by those with tertiary education who produced as low as 1.75 bags. The trend, however, showed that among all the various educational backgrounds, there was an increase in the trend of production over the period. This is shown in Table 4 below;

Table 4: Crosstab between the level of education and cocoa production

Level of Education	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Mean
No Formal Education	7.78	8.00	6.85	5.87	5.58	6.11	6.23	6.17	4.43	4.00	6.10
Primary	7.76	8.35	7.30	6.22	4.74	5.59	6.54	6.84	3.97	3.00	6.03
JHS/Middle	5.88	6.20	5.51	5.17	4.52	4.94	5.61	5.63	3.72	3.45	5.06
SHS/Vocational /Technical	17.44	16.22	13.89	11.11	9.67	8.0	8.0	5.0	3.78	2.89	9.60
Tertiary	3.33	2.33	2.00	1.00	1.33	1.00	1.83	2.17	1.50	1.00	1.75

Source: Field Study, 2023

Income was also considered. With income levels and the level of cocoa production, it was observed that those who earn between 500 and 800 cedis had the highest earnings when it comes to cocoa production with an average output of 12.90 bags. This is followed by those who earn between 801 and 1000 Ghana cedis with an average of 9.1 bags a year. Those who earn between 201 and below 200 followed in that order with an average production of 6.24 and 5.27 respectively. Those who produce the least where the highest income earners. This shown in Table 4.4

Table 5: Crosstab between the Level of Income and Output of Cocoa

Level of Income	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Mean
Below 200	6.41	6.91	5.91	5.10	4.37	5.11	6.00	5.60	3.63	3.66	5.27
201 - 500	8.73	8.18	7.69	7.00	6.37	5.75	5.72	6.14	4.23	2.64	6.24
501 - 800	18.00	16.50	14.50	11.00	9.50	10.50	12.50	18.50	12.00	6.00	12.90
801 - 1000	9.60	11.60	11.40	10.00	9.80	9.20	8.40	7.60	7.00	6.40	9.10
Above 1000	5.67	6.67	1.33	6.00	1.67	8.00	3.33	5.33	2.33	3.33	4.37

Source: Field Study, 2023

The study also went ahead to look at the relationship between being a member of a farmer organization and the average output per year. In this vein, respondents were asked whether they belonged to a farmer organization and the results indicate that those who were part of a farmer organization produced comparatively higher number of bags on the average per year compared to those who were not part of any farmer organization. For instance, on the average, whilst those who are part of a farmer association produced 7 bags, those who are not part of any farmer organization produced 4.40 bags (shown in Figure 6). This cuts across all the various years with those belonging to farmer associations producing more.

Table 6: Affiliations to Farmer Associations and Average Cocoa Production

Farmers affiliation to association	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Mean
Yes	8.50	9.00	8.1	7.2	6.70	7.00	7.20	7.20	4.90	4.00	7.00
No	6.00	6.00	5.00	4.5	3.60	4.10	5.00	3.50	2.90	3.00	4,40

Source: Field Study, 2023

Table 7: Perception of the Impact of Temperature on Cocoa Yield

Perception on the Influence of cocoa yield	Frequency	Percentage
Strongly Agree	92	46
Agree	61	30
Neutral	16	8
Disagree	31	15
Strongly disagree	-	-

Source: Field Study, 2023

In other to assess farmers' perception of the factors that influence cocoa production. Their perceptions were sought with some indicators. These include temperature, rainfall, pruning, use of hybrid seeds, irrigation, planting of shade trees, among others. In this regard, respondents were first asked on their perception on the influence of temperature on cocoa production. The results indicate that the highest proportion of respondents who number 92 (46%) strongly agreed that temperature has ab influence on the output of cocoa. The second-highest category of respondents who number up to 61 (20%) agree that temperature affects the output of cocoa. Others also had a neutral stance and they were 16 (8%) whilst 31 (15.5%) disagreed. None of the respondents strongly disagreed that temperature affects the output of cocoa. During the FDG's and interviews, it was revealed that although sunshine helps in the increase of cocoa yield, too much of it causes adverse effects on cocoa yield such as the cocoa tree bearing fewer fruits. Also, the cocoa leaves and roots become affected. In reference to the above, the following statement was made by a participant in the FGD.

…When there is prolonged sunshine, it affects the cocoa leaves and roots, and the cocoa cannot bear much fruit…planting of trees in the cocoa farm and the cocoa trees should not be planted close to each other. There should be a space of 30 feet between them. This helps reduce the impact of sunshine. [FGD participant in Bodi]

The nest factor that was considered is rainfall. With rainfall, a higher percentage of respondents (73.5%) strongly agreed that rainfall affects the output. This is followed by 20% of the respondents who agreed that rainfall affects cocoa output. Only 6% disagreed and 0.5% were neutral. None of the respondents strongly disagreed that rainfall affects cocoa yield.

Table 8: Perception of rainfall as an influence on Cocoa output

Perception on the Influence of cocoa Yield	Frequency	Percentage
Strongly Agree	147	73.5
Agree	40	20.0
Neutral	1	0.5
Disagree	12	6.0
Strongly disagree	-	-

Source: Field Study, 2023

The next factor that was considered is pruning. With pruning as high as 150 (75%) of the respondents strongly agreed that it affects cocoa output followed by 37 (18.5%) of them who agreed. Only 3 (1.5%) were neutral whilst 10 (5%) of them disagreed.

Table 9: Whether Pruning affects Cocoa Production

Perception on the Influence of cocoa Yield	Frequency	Percentage
Strongly Agree	150	75
Agree	37	18.5
Neutral	3	1.5
Disagree	10	5
Strongly disagree	-	-

Source: Field Study, 2023

In support of the results above, a farmer had this to say:

> *'...regular weeding at least thrice a year and pruning so that air and sunshine can penetrate. Also spraying and fertilizer application can improve the cocoa yield.''* [a farmer during a FGD].

With the use of hybrid seeds as a factor that affects cocoa output, the study revealed that majority of the respondents (65.5%) strongly agreed that they affect cocoa yield. This is followed by 30.5% who agree and 4.0% who remained neutral. None of the respondents disagreed or strongly disagreed (Figure 10).

Table 10: Use of Hybrid Seed as a factor that affects Cocoa Output

Perception on the Influence of Cocoa Yield	Frequency	Percentage
Strongly Agree	131	65.5
Agree	61	30.5
Neutral	8	4.0
Disagree	-	-
Strongly disagree	-	-

Source: Field Study, 2023

Farm Management Practices Adopted by Farmers and their Influence on Cocoa Yield

This section of the chapter looks at farm management practices adopted by farmers and how that influences their cocoa yield. The study first asked respondents how often they are engaged in the various cocoa management practices and how often they adopt those practices.

First of all, respondents were asked which farm management practices they are engaged in. The data revealed that management practices such as pruning, use of hybrid seeds, fertilizer application, use of fungicides and insecticides, a strong majority of the

respondents practices them. However, when it comes to irrigation, planting of shade trees and hand pollination as farm management practices, only a small fraction of the respondents representing less than 20% engage in them (Table 23)

Extension Officers

The study also sought to find out whether farmers receive extension services. The results indicate that 142 of the respondents representing a majority of 71.0% do not receive services, whiles the minority of 53 respondents representing 27.2% have access to extension services (Table 11). the findings in this section confirms an earlier study by Baffoe-Asare et. al., (2013) who found out that farmers' adoption of cocoa invitations is linked to their production capacity and farms.

Table 11: Access to Extension Services

	Frequency	Percentage
Yes	58	29
No	142	71

Source: Field Study, 2023

The study further went ahead to ask respondents how often extension officers visit their farm. The data indicate that a majority of 147(73.5%) claim that no extension officers visit their farm at all. This is followed by 23(11.5%) of the respondents who claimed that extension officers visit them twice in a year whilst 10% said once, and 5.5% said thrice a year (Table 12). The finding confirms an earlier research by Dorward (1999); Oyekale and Oladele (2012) and Ogunsola and Oyekale (2013) who affirm the significant influence of spraying and farm size on cocoa production.

Table 12: Frequency of visit by extension officers

	Frequency	Percentage
Once	147	73.5
Twice	23	11.5
Thrice	20	10.0
None	10	5.0

Source: Field Study, 2023

The study went on to look at the rate at which farmers engage in these farm management practices. The results indicate that respondents very often practice application of fungicides, insecticides and prune their cocoa trees. However, respondents did not engage in the planting of shade trees or practiced irrigation and hand pollination exercises. During the FGDs and interviews, it was revealed that although fertilizer application, use of fungicides and pesticides help increase cocoa yields, too much of it causes adverse effects on cocoa yield and life span. Also, the cocoa leaves and roots become affected.

Excerpt from FGDs in Akontombra:

.....When there is too much application of fertilizer, fungicides and pesticides it affects the cocoa leaves and roots and the cocoa cannot bear much fruit. Currently, most of the cocoa trees are dying and the yields have reduced drastically [FGD participant in Akontombra].

This finding is at variance with the results of a similar study conducted by Effah et. al., (2017) who investigated the determinants of cocoa production in the Ashanti region in Ghana. With Ordinary Least Squares (OLS) estimates from a Cobb-Douglas production function, the study found that the total revenue and hired labour variables had significant influence on cocoa production. On the other hand, the number of times

of mass spraying and farm size variables were statistically insignificant. These results were contrary to those of Doward (1999); Oyekale and Oladele (2012) and Ogunsola and Oyakale (2013) who affirm the significant influence of spraying and farm size on cocoa production.

Challenges Associated with Cocoa Farm Management Practices

The study results indicate that respondents either face challenges or do not, depending on the type of management practices they engage in. As shown in Figure 4.3, farm management practices such as fertilizer application, hand pollination exercise, planting of shade trees and irrigation had a small proportion of the respondents indicating that they face challenges in practicing them. On the other hand, farm management practices such as the application of insecticides and fungicides and fertilizer had a majority of the people indicating that there are challenges that prevent farmers from practicing them. For instance, about 92% of respondents indicated that they face challenges when it comes to the application of insecticides and fungicides. Whilst only 2.5%, 6.6% and 4.5% said they have challenges practicing hand pollination, planting of shade trees and irrigation respectively.

However, the qualitative data revealed the specific challenges encountered by the farmers in practicing farm management activities. These challenges can be categorised under three main factors; level of education, lack of funds and political factors.

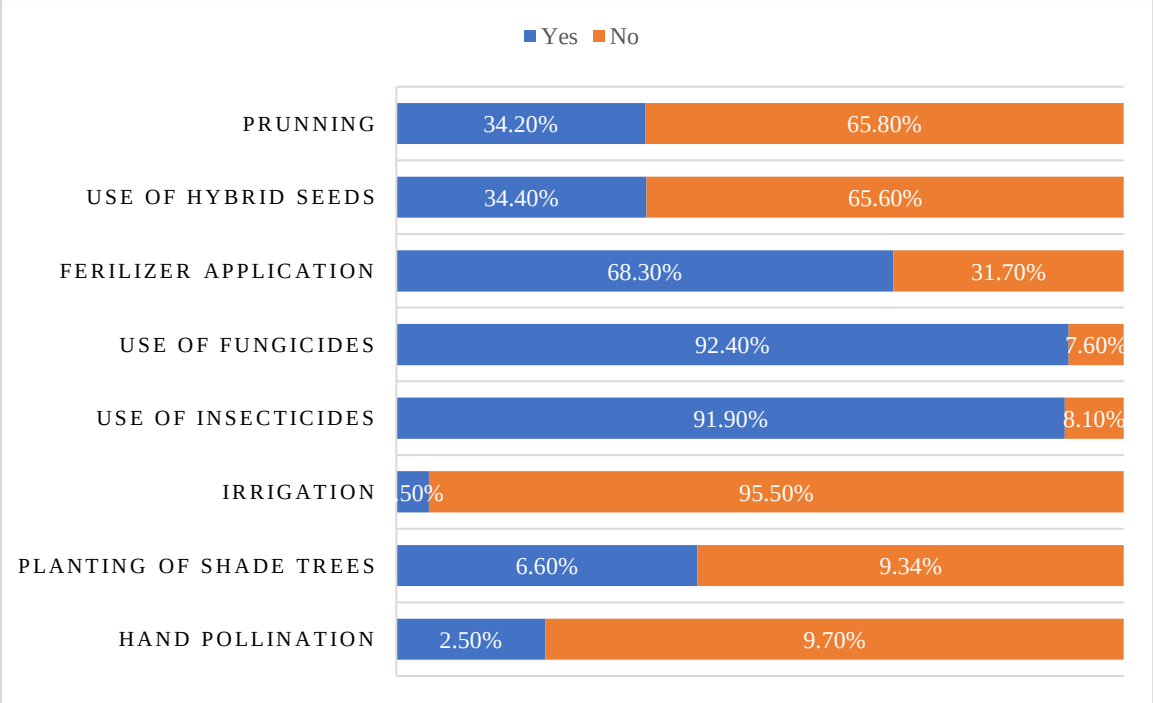

Figure 7: Challenges in Managing Cocoa Farms

Financial Challenges

Most of the farmers do not have access to credit facilities and also their income levels are very low. This inhibits their ability to purchase farm inputs such as fertilizer, weedicides, pesticides, fungicides among others. This is coupled with the fact that some of the farmers are old and require hired labour to undertake some of the farm management practices, but the lack of financial resource limits their abilities to perform these farm management practices fully. In support a respondent made the statement below;

> *....the chemical are very expensive and money is hard to come by these days. For somebody like who does not have a government work, I don't have access to bank loans. How can I buy fertilizer or "Kumakate" to spray my farm?* [42-year-old interviewee].

Inadequate Education and Training

A lot of the farmers recounted their limited access to extension services that affect them when it comes to the right application of certain farm management practices. Extension officers hardly visit respondents, especially those who are not part of farmer associations. Due to this, some farmers do not understand the significance of certain farm management practices. This was evident in respondents' knowledge on the significance of hand pollination and irrigation.

Political Factors

The study revealed that political factors played a role in farm management. The cocoa mass spraying exercise is undertaken by persons appointed by the ruling government, and these appointees are residents in these cocoa farming communities. Therefore, if a cocoa farmer is not known to be a member of the ruling party, they are sabotaged in the mass spraying exercise, either by not spraying their cocoa farms with the right chemicals or their farms may not be sprayed at all. Farmers will therefore have to find alternative ways of spraying their farms which is very difficult. One respondent had this to say:

> *I some of the money I make from the proceeds of the cocoa to buy chemicals to supplement what the government is providing. If you want to rely on what the government provides alone, you will not get anything. There is too much politics in the cocoa mass spraying* [Male interviewee from Cholicholi]

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter is the last chapter of the study. It deals mainly with the summary, conclusions and recommendations of the study. The summary provides a brief description of the entire study. The conclusion focuses on the study's major findings and seeks to answer the research questions and the recommendations makes suggestions for future research and policies within the cocoa sector.

Summary

With the administration of questionnaires, focus group discussions and in-depth interviews, the study was able to achieve its objectives set in chapter 1. The first objective of the study was to examine the trend in cocoa production of farmers from 2007 to 2017. Findings from the study revealed that cocoa production among the farmers increased from 2007 to 2017 although there were some drops in production in some years. Looking at the rural-urban dichotomy, it was observed that urban communities tend to have higher production in terms of cocoa production compared to rural area. In terms of age, those who were 60 years and above had the highest average production of cocoa over the years looked at.

The second objective of the study was to assess farmers' perception on the factors that affect cocoa yield or output. In this regard, the study revealed that more farmers were of the view that climatic factors such as rainfall and temperature have an effect on cocoa yield whilst revealing the consequences of either too much rain or temperature on cocoa yield. It emerged that too much rainfall causes rotting of cocoa pods and requires regular pruning when that occurs. With respect to farm management practices, it was revealed that a higher majority of farmers perceived that fertilizer

application, insecticide and fungicide spraying have effects on cocoa yield. However, the majority of farmers perceived the planting of shade trees, irrigation and hand pollination exercise as having no influence on cocoa yield.

The third objective looked at the farm management practices adopted by farmers and how it affects cocoa yield. It was revealed in the study that farmers who perceived certain farm management practices as having an impact on crop yield actually practiced them whilst those who perceived that farm management practices had no impact on crop yield practiced them the least. In this vein, the use of fertilizer, spraying with insecticides and fungicides, planting of hybrid seeds and pruning was frequently practiced by the cocoa farmers as compared to the others – hand pollination, irrigation and planting of the shade trees which were seldomly practiced by the farmers. The level of impact on cocoa yield perceived by the respondents was very high as majority of respondents all agreed to the impacts of fertilizer, insecticides, fungicides and hybrid seeds on coco yield. However, with hand pollination, irrigation and shade trees, majority of respondents remained neutral to their benefits on cocoa yield.

The forth objective was to assess the challenges of practicing these farm management practices. Three main factors were highlighted as affecting cocoa farmers in the practice of identified farm management practices. These include inadequate financial resources, political factors and the lack of education and training on farm management practices.

Conclusions

The study can conclude that there is an increasing trend in cocoa production in the Western-North Region, all though there were some dips in production in some of the years. These dip in production in some of the year can be associated with several

factors including political factors such as change of government. The increased yield also results from government interventions such as cocoa mass spraying exercise and an increase in the production prices of cocoa.

The study also concludes that both natural and anthropogenic factors affect cocoa yield. The natural factors include rainfall and temperature, whiles anthropogenic factors include farm management practices. The climatic factors affect cocoa yield both positively and negatively depending on the magnitude of their occurrence. With management practices, the perceptions are that not all management practices affect cocoa yield and farmers were either not aware of the effects of some management practices or they did not perceive them to have any benefits on cocoa yield. Therefore, it is important to emphasize farmers' perceptions of factors that affect cocoa yield are important in the course to increase cocoa yields by stakeholders.

The study also revealed that farmers engage in practices such as fertilizer application, spraying insecticides and fungicides, pruning and the use of hybrid seeds to increase cocoa seeds. They, however, do not engage in other management practices, even though research has proven that these practices increase cocoa yield.

It can therefore be concluded that farm management practices engaged in by cocoa farmers lead to increase in yield although there are other management practices that equally provide increased yields, but farmers hardly practice them.

Recommendations

Based on the study findings, the following recommendations were made:

- The government through the Ministry of food and Agriculture should ensure that more extension officers are sent to cocoa farming communities to educate the farmers. This can be done by targeting farmer associations and offering

training to their members so that they can share the knowledge gained from the training to other farmers. This will help farmers apply the right farm inputs and methods on the farm to increase cocoa yield. Also, farmers should be introduced to new and better ways of cocoa farming that can increase their output and income.

- The study also recommends that cocoa farmers are provided with financial resources to be able to acquire certain farm inputs to apply on their farm to increase cocoa yield. This can be in the form of credits to farmers through special arrangements involving the government and COCOBOD through a partnership with banks to offer flexible credit facilities to the farmers to be able to acquire farm inputs. Also, special arrangements can be made with cocoa purchasing clerks to offer soft loans to farmers, so they can pay back during cocoa seasons.
- The study also recommends that policies and interventions by the government to support farmers in terms of farm inputs and other services should be given to non-partisan actors such as COCOBOD and other appointing political actors to handle. This will take away the sabotage of some farmers who are not aligned with the party in power spread the benefits to larger famer populations.
- The study was limited in respect to the time required to complete the study. Therefore, this study was based on farmer perceptions rather than empirical data that is testable with respect to the impact of certain farm practices on cocoa yield. It is therefore recommended that, future studies concentrate on empirical evidence by monitoring farm management practices and their impact on cocoa yield or output over a period of time. This will help in understanding the real

contributions of farm management practices to cocoa yield for the purposes of planning.

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APPENDIX

QUESTIONNAIRES FOR COCOA FARMERS

Community: ……. Questionnaire no: ……

INTRODUCTION

This questionnaire is being administered by an MSc in Monitoring and Evaluation as part of the requirements for the attainment of MSc degree in Monitoring and Evaluation. The information being sought is strictly for academic purposes and confidentiality is assured. We, therefore, count on your corporation in this regard.

Thank you.

SECTION 1: Demographic Characteristics

1. Sex

   a) Female b) Male

2. Age

   ……..

3. Level of education

a) No formal education b) Primary c) JHS/Middle School d) SHS/Vocational/Technical

e) Tertiary f) Others (specify)…….

4. Marital Status

a) Married b) Divorced c) Single d) Separated e) Widowed

4. Average monthly income

   ……

5. Religion

a) Christian b) Muslim c) ATR d) No religion

6. Ethnicity

   ……

7. Are you a member of any cocoa farmer association?

a) Yes b) No

8. Household size

   ……

9. What is the size of your farm?

   ……

SECTION 2: Factors That Affect Your Yield

10. Indicate your level of agreement or disagreement on the effects of the following factors on cocoa yield.

Factor	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
Temperature					
Rainfall					
Soil Fertility					
Farm management practices					

SECTION 3: Farm Management Practices

11. Which of the following farm management practices are you engaged in? (tick all that apply)

Farm management practice	
Pruning	
Use of hybrid seeds	
Fertilizer application	
Use of fungicides	
Use of insecticides	
Irrigation	
Timber planting	
Hand pollination	

12. Do you have access to extension services?

a) Yes b) N0

13. If you answered yes to the question above, how often do extension officers visit your farm?

a) Once b) Twice c) Thrice d) More than three times a year

14. How often do you practice the following farm management practices?

Farm management practice	Very often	Often	N/A	Not often	Not too often
Pruning					
Use of hybrid seeds					
Fertilizer application					
Use of fungicides					
Use of insecticides					
Irrigation					
Timber planting					
Hand pollination					

15. The following management practices affect cocoa yield

Farm management practice	Strongly Agree	Agree	Neutral	Strongly Disagree	Disagree
Pruning					
Use of hybrid seeds					
Fertilizer application					
Use of fungicides					
Use of insecticides					
Irrigation					
Timber planting					
Hand pollination					

16.

17. Do you face any challenges on the application of the of the following farm practices?

Farm management practice	Yes	No	Challenge faced
Pruning			
Use of hybrid seeds			
Fertilizer application			
Use of fungicides			
Use of insecticides			
Irrigation			
Timber planting			
Hand pollination			

SECTION 4: Cocoa Yield

18. On average, how many bags did you harvest in the following years?

Year	Number of bags produced
2017	
2016	
2015	
2014	
2013	
2012	
2011	
2010	
2009	
2008	

19. What do you think should be done to ensure an increase in cocoa yields?

…….....

.....

THANK YOU

Interview and Focus Group Discussion Guide

1. Biodata of respondents
2. Number of years engaged in cocoa farming
3. Perception of climatic factors that affect cocoa yield
4. What farmers do to combat climatic challenges
5. Perception on-farm management practices that affect cocoa yield
6. What farmers are engaged in to increase cocoa yield
7. The challenges they face in engaging in those practices
8. What needs to be done to ensure an increase in cocoa yields