FARM MANAGEMENT PRACTICES AND ITS CONTRIBUTION TO COCOA YIELD IN THE ASUTIFI NORTH DISTRICT OF GHANA

BY

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THIS THESIS IS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN GEOGRAPHY AND RESOURCE DEVELOPMENT

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DECLARATION

I hereby declare that this thesis is my own work which was done under supervision for the award of Master of Philosophy degree in Geography and Resource Development at the University of Ghana, Legon. Also, this thesis has not been submitted elsewhere by me or any other person for the award of the same degree or another degree.

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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 Asutifi North District of Ghana. Using a mixed-method approach, questionnaires were administered to 200 farmers in the Asutifi North district using a multi-stage sampling technique (cluster and convenient sampling). Moreover, one chief farmer in the district and a farmer in each study community were interviewed. Focus Group discussions were also organized in each community with a group of farmers, not more than 10 in each instance. 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, 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.

DEDICATION

I dedicate this thesis to my wife, Mrs Juliana Badu and my children, Janice Badu Pokuaa and Badu Alex Junior.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

BOG	Bank of Ghana
COCOBOD	Ghana Cocoa Board
CMB	Cocoa Marketing Board
CPP	Convention People Party
CRIG	Cocoa Research Institute of Ghana
CODAPEC	Cocoa Diseases and Pest Control Programme
CMC	Cocoa Marketing Company
CSIR	Council for Scientific and Industrial Research
DOI	Diffusion of Innovation
ERP	Economic Recovery Programme
FDG	Focus Group Discussion
GDP	Gross Domestic Product
GSS	Ghana Statistical Service
IDT	Integrated DNA Technology
LBC	Licensed Buying Companies
MOFA	Ministry of Food and Agriculture
MT	Metric Tonnes

NLC	National Liberation Council
OECD	Organisation for Economic Co-operation and Development
PHC	Population and Housing Census
QCD	Quality Control Division
SPU	Seed Production Unit
SPSS	Special Package for the Social science
UGFCC	United Ghana Farmers Council of Cooperatives
US$	United State Dollar
USDA	United State Department of Agriculture

CHAPTER ONE: STUDY BACKGROUND

1.1 Introduction

Throughout the world, agriculture has been a significant driver of development in diverse ways. Most of the raw materials that industries feed-on are agricultural products with extended value chains, providing employment, income, among others to a vast majority of people. Although the services sector is gradually taking over in terms of employment, agriculture is still significant, with about 28% of the world labour force engaged in it (World Bank, 2018). However, there are variations with the total number of people employed in the agricultural sector in terms of developed and developing nations. Whiles the developed countries have a comparatively lower representation of employment in the agriculture sector, developing nations, on the other hand, have more than half of the workforce engaged in agriculture. In the European Union, for example, agriculture employs 4% of the entire workforce while in Sub-Saharan Africa, agriculture employs 57% of the active population (World Bank, 2018).

In Ghana and several other developing countries, agriculture is a strong pillar in economic development. Although the share of the agricultural sector has seen a decline in terms of employment and contribution to GDP in recent years, the sector is still crucial in the development of the Ghanaian economy. In 2017, the agricultural sector contributed a total of GHC 35,047 million, representing 18.3% of total GDP (GSS, 2018) and employing 41% of the active labour force in Ghana (World Bank, 2018). Within the agricultural sector, cocoa has over the years been the single most important crop with the most influence on economic sustainability to Ghana.

In 2010 and 2011, Ghana recorded the highest volume of cocoa on the world stage, attaining a high record level of 1,004,000 metric tons (USDA, 2015). The cocoa industry makes up about

30% of Ghana's total export earnings, making it the main export crop (USDA, 2015). Cocoa beans from Ghana are acknowledged for their quality and depth of flavour, being more abundant in theobromine and flavonoids than beans from other parts of the world, making it the world's standard against which all cocoa is measured (Ashitey, 2012).

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 Rogers (1983), 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 whiles 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.

1.2 Problem statement

Cocoa has been 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 Authority (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 Anon (1999), 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 (Dormon et al., 2004). 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 (see 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 (see 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 is 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 is 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 Asutifi North District 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.

1.4 Research objectives

The overall objective of the study is to assess the determinants of cocoa production in the Asutifi North District 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 analyse challenges associated with cocoa farm management practices.

1.5 Research hypothesis

The following hypothesis led the conduct of the study:

1. H_0 = there is no relationship between the age, educational level and income of farmers and the kind of farm management practices they engage in.

   H_A = there is a relationship between the age, educational level and income of farmers and the kind of farm management practices they are engaged in.
2. H_0 = there is no relationship between the type of farm management practices and output in cocoa yield.

   H_A = there is a relationship between the type of farm management practices and output in cocoa yield.

1.6 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.

1.7 Organization of the Study

The study is organised 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 are discussed followed by the research design, sources of data, sample size determination and sampling techniques, among others. Chapter four contains the results of the thesis according to the objectives of the study whiles chapter five provides discussions to these study findings.

Chapter six contains the summary, conclusions and recommendations of the study based on the study findings.

1.8 Chapter Summary

This chapter looked at the background to the thesis where issues such as the introduction, problem statement, objectives and research questions are discussed. Also, the chapter talked about the hypothesis and organization of the thesis.

CHAPTER TWO: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 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.

2.2 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 plantation 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.

2.2.1 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 (Hill, 1963). 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 (Hill 1963). 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 (Stryker, 1990). 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 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 (Vigneriand and Santos, 2008). 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 (Brooks et al., 2007). 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).

2.2.2 Production of cocoa in Ghana

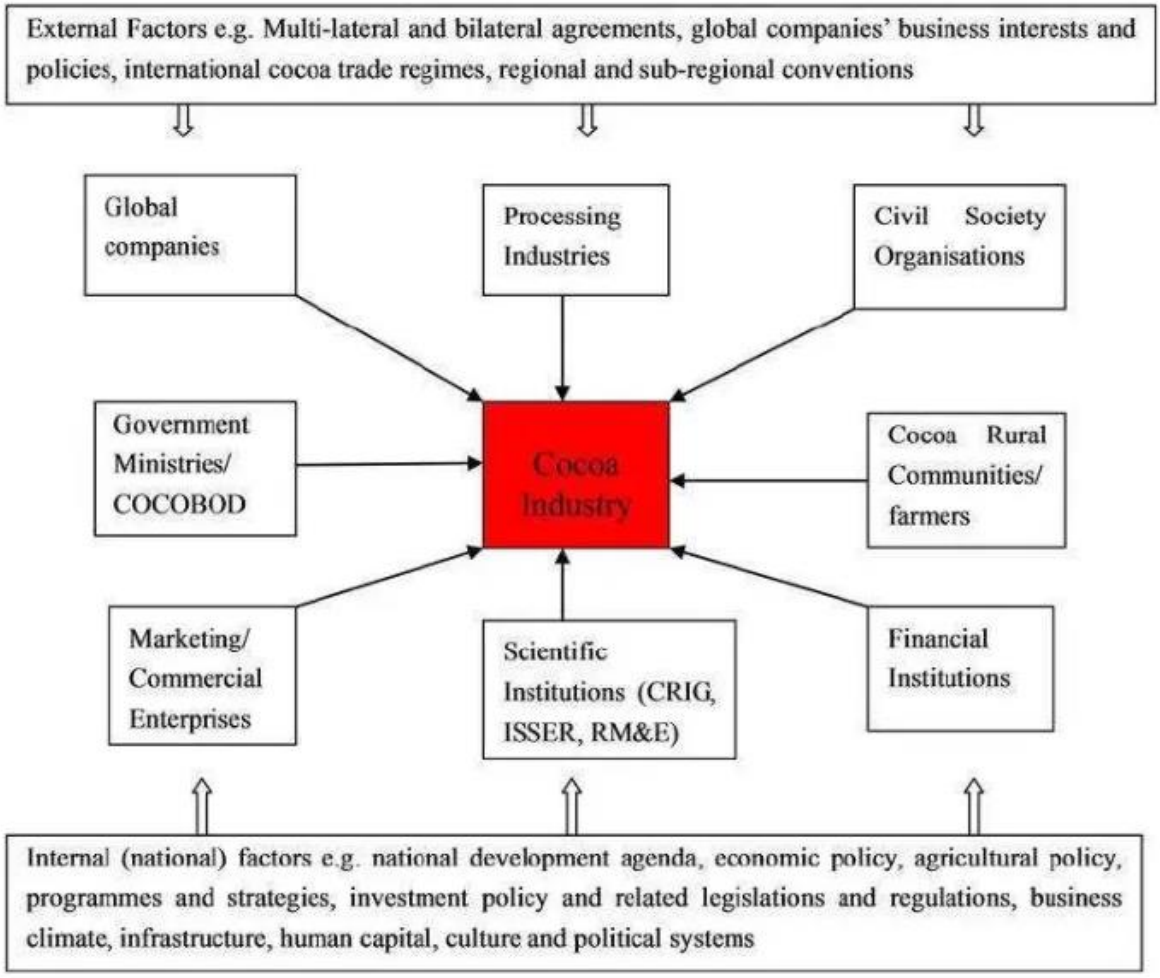
In Ghana, the cocoa plant grows well mainly around the tropical zone with the assistance of certain factors such as excessive rain rainfall, ample humidity(temperature) and high year-round sunshine (heat). The plant requires protection from the sun and wind during the production process. The fruits on 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, only2 per cent 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 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 2.1: Diagram of the cocoa innovation system—Critical actors and influencing factors.



Source: 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 increase 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 are hired to transport sealed 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) forms a subunit of the LBCs. Currently, PBC controls about 35% of cocoa bean 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, pest 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 the 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 right 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.

2.4 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.

2.4.1 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 MASDAR (1998), 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 COCOBOD in (1995), 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 on the environment which needs to be assessed in cocoa cultivation (Owusu-Manu, 1985). Studies have shown that there is a positive relationship between the frequency of weeding and yield in crops (Dimes, Muza, Malunga and Snapp, 2001).

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 (Idachaba & Olayide, 1976; MASDAR, 1998). 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 variety 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 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.

With respect to farm size and its effects on cocoa yield, farm size negatively influences cocoa yield. According to Quansah et al. (2000), 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 ($P < 0.05$).

2.4.2 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.

2.5 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 challenge 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 Kwanashie et. al., (1998), 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 license. 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 from 30-40% of the world 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 raining season when a lot of seeds are destroyed for lack of these facilities.

2.6 Diffusion of Innovation Theory

The concept of diffusion was first studied by the French sociologist Gabriel Tarde in late 19th century (Kinnunen, 1996) and by German and Austrian anthropologists and geographers such as Friedrich Ratzel and Leo Frobenius. 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 (Valente and Rogers, 1995). A study of the adoption of hybrid corn seed in Iowa by Ryan and Gross (1943) solidified the prior work on diffusion into a

distinct paradigm that would be cited consistently in the future (Valente and Rogers, 1995). 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, Rogers (1962) 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 Diffusion of Innovation Theory was developed in 1962 by an American known as E.M. Rogers. 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.

Triability - 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 (Röling, 1990), and

comprehensive approaches by considering the role of stakeholders and institution that make up the Agricultural Innovation System (Klerx et al., 2012). According to Schumpeter (1939), 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). Fagerberg (2003), 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. Brown (1981: p507) 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

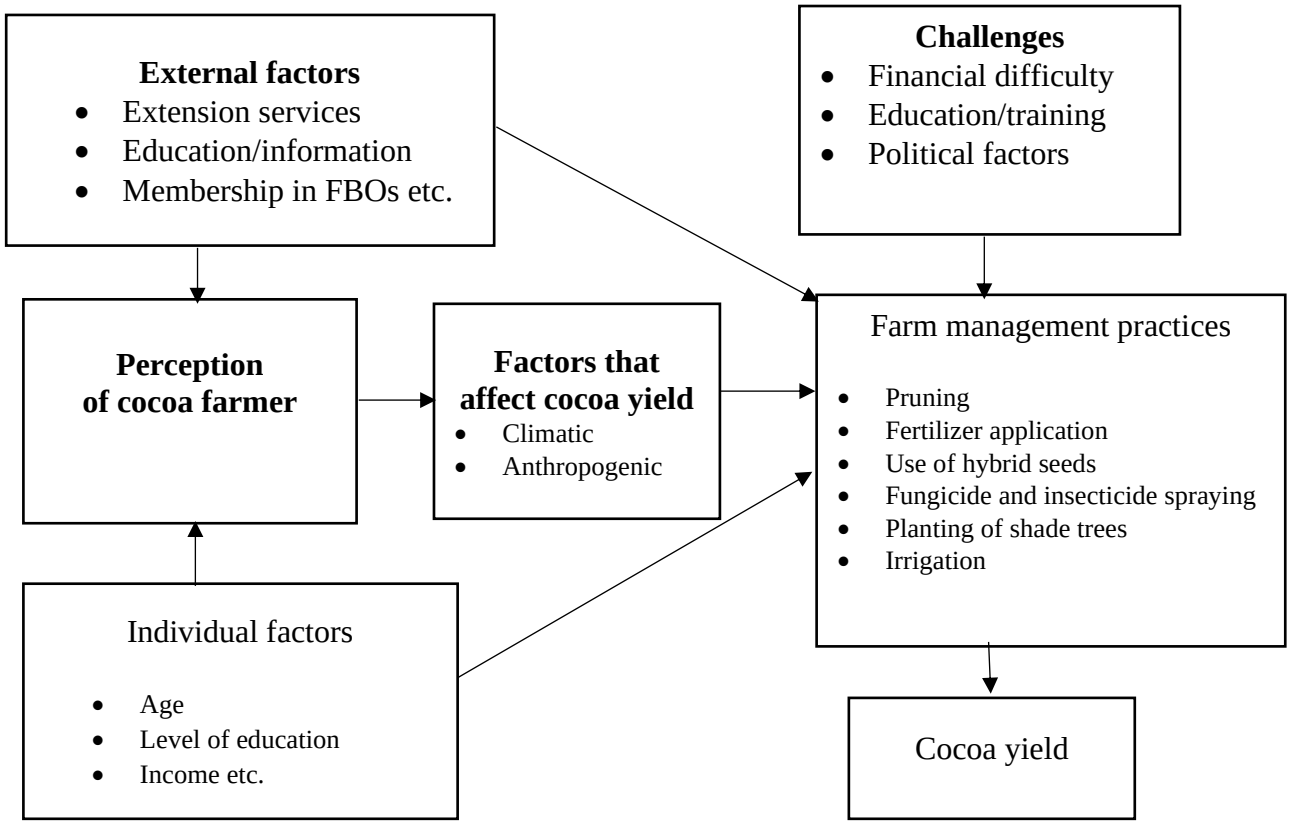
for the innovations and subsequent adoption by other farmers is also explored. In using the IDT as an analytical frame for the study, issues such as the sources of information and how farmers came to adopt and accept certain practices were explored. Also, the challenges in adopting certain practices 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.

2.7 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 2. 1: A conceptual framework showing the interactions between perceptions, farm management practices and cocoa yield



Source: Author's own construct, 2019

2.8 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: STUDY AREA AND METHODOLOGY

3.1 Introduction

This chapter is in two parts. The first part discusses the study area (Asutifi North District) 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.

3.2 Study Area

3.2.1 Location

This study was conducted in the Asutifi North District which can be found in the Brong Ahafo Region of Ghana. The district capital is Kenyasi. In terms of the physical characteristics, the forest dissected plateau is the main formation of the district which has an average height of about 700ft above sea level. In the North, the district is bounded by the Sunyani Municipal, in the East, it is bounded by Tano South District, whiles Dormaa East District, Asutifi South District, Asunafo North and South Districts and Ahafo Ano South and North Districts to the North West, the west, the South West and South East respectively. The map of the district can be found in Figure 3.1. in terms of land size, the district has a total area of 1,500km^2. It is among the smallest districts in the Brong Ahafo Region. In terms of population, the total number of people in the district as of 2010 was 52,259, which forms 2.7% of the population of the Brong Ahafo Region (GSS, 2012).

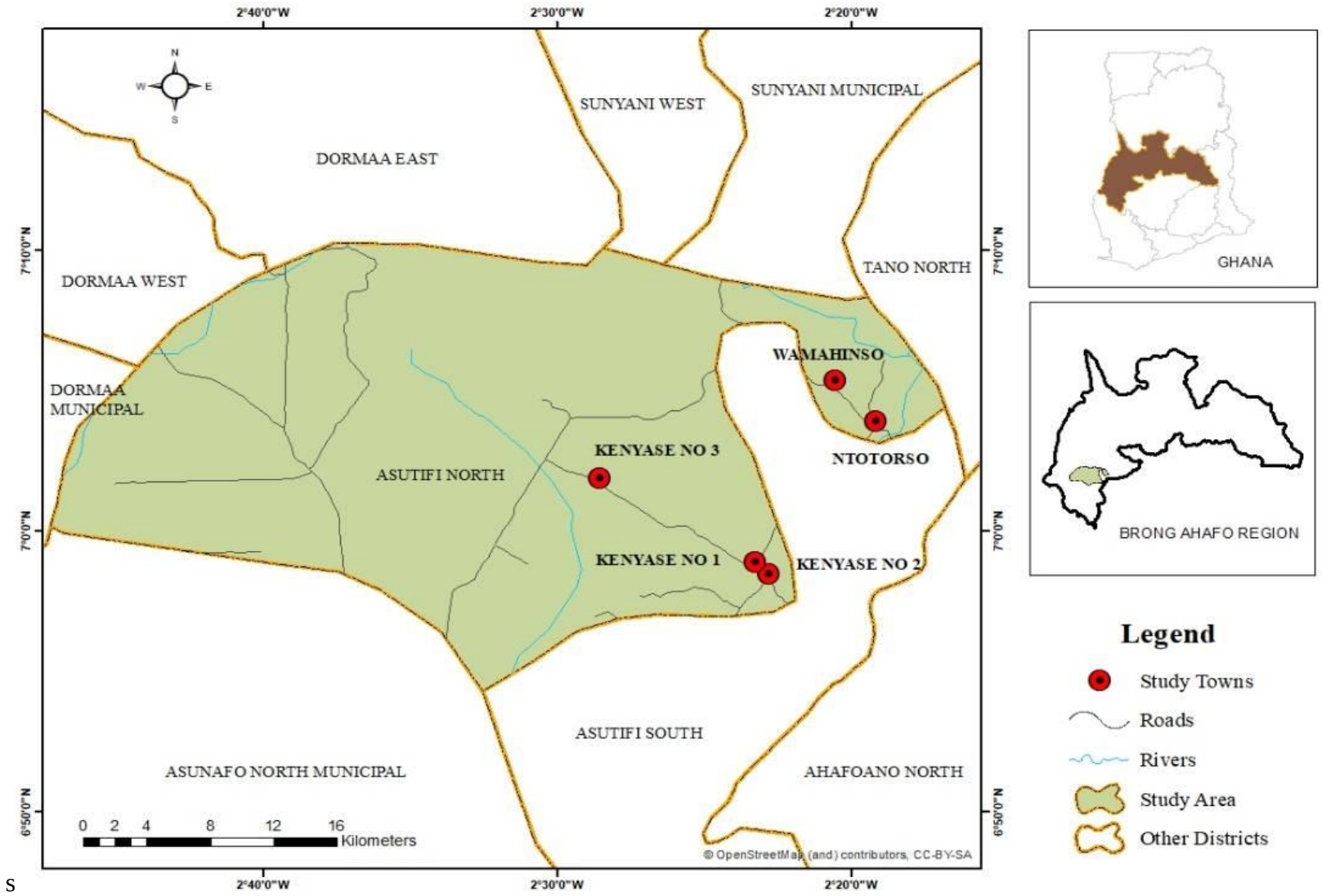


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Figure 3. 1: Map of Study Area

Source: Author, 2018

3.2.2 Climate and Vegetation

The equatorial zone of the district is the Wet Semi- Equatorial which is a double maxima rainfall. The mean annual rainfall is between 1250mm and 2000mm. The major rainy season starts from May and ends in July, peaking in June. The minor season on the other hand between September and November with its minimum in October. The District comes under the influence of the wet maritime air mass around this same time. Relative humidity ranges from 75% - 80% and 70% - 80% in other times of the year (GSS, 2012).

3.2.3 Economic Activity

In terms of the economically active population, 72.9% of the population are active who are above the age of 15. The economically inactive are 27.1% of the population. In terms of employment rate, 93.5% of the economically active are employed with the remaining being unemployed. The highest category of the economically inactive is students (47.6%) whiles 31.1% are into household chores. The remaining 3.8% are either physically challenged or too ill to work (GSS, 2012).

Of the employed population, about 58.0 per cent are engaged as skilled agricultural, forestry and other workers, 11.2 per cent in service and sales, 10.4 per cent in craft and related trade, and 6.5 per cent are engaged as managers, professionals, and technicians.

Of the active population, those who are self-employed make up 66.6% with no employees with 17.5% being employees, 8.6% are contributing family workers, 2.3% are casual workers, and 0.5% are domestic employees (house helps). Overall, men constitute the highest proportion in each employment category except self-employed without employees and the contributing family

workers. The private informal sector is the largest employer in the district, employing 80.0% of the active labour force whilst the private informal sector employs 13.1 per cent (GSS, 2012). Because of the long history of cocoa production in the area, and also good nature of the topography, vegetation and fertile soil tend to promote the cultivation of cash crops such as cocoa, oil palm and food crops like plantain, yam, cassava etc. Cocoa farming is one of the lucrative business undertaken by local people.

3.3 Methods

3.3.1 Research design

This study adopts a multiple case study where 5 communities in the Asutifi North District 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 systemically 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, refer 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,

biased 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 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.

3.3.2 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.

3.3.3 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 Asutifi North District. 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.

3.3.4.1 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.

3.3.4.2 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.

3.3.5 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 Asutifi North district 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 constraint.

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

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 3. 1: Sample size and target population for interviews and FGDs

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

3.3.6 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 Asutifi North analytical report by the GSS the researcher observed that all the communities in Asutifi North district were similar in terms of the socio-economic characteristics. Therefore, in order to ensure equity in terms 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 to 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

Wamahinso, Ntotroso, Kenyase No. 2, Kenyase No.1 and Kenyase No. 3, with Kenyasi No. 1 and Kenyasi No. 2 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.

3.3.7 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.

3.4 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 analyzing the data are discussed.

CHAPTER FOUR: RESULTS

4.1 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 were displayed. 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.

4.2 Demographic characteristics of respondents

The first demographic factor that was considered is the gender of respondents. The data revealed that majority of the respondents are males whiles the remaining are females. At the community level, however, this distribution was not homogenous. Kenyasi No. 2 had the highest majority of male respondents followed by Wamahinso. Ntotroso had the lowest difference between males and females (Table 4.1). 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 Kenyasi No. 3, all the communities visited had the least category of respondents belonging to the 20-30 years category (Table 4.1).

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 Kenyasi No. 1 and Kenyasi No. 3 where

those belonging to the JHS/Middle school category had 40.8% and 45% representation respectively (Table 4.1). A large majority of the respondents were married. This figure was quite similar in all the communities with the exception of Ntotroso, where although 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 4.1).

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 4.1). 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 4.1).

Majority of the respondents belonged to a farmer organization. In Kenyasi No. 3, half of the respondents belonged to a farmer organization whilst Ntotroso had the highest majority of two-thirds of farmers belonging to a farmer organization (Table 4.1). 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 Wamahinso and Ntotroso had a majority of respondents belonging to a household with members 4-6, the other communities were all in the minority (Table 4.1).

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. Kenyasi No. 2 had a majority of respondents having a farm size between 3 and 7 acres which is the highest percentage in all the communities (Table 4.1).

Table 4. 1: Demographic characteristics of respondents

	TOTAL		KENYASI NO. 1		KENYASI NO. 2		KENYASI NO. 3		WAMAHINSO		NTOTROSO	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq.	%	Freq.	%
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	59	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
>60	37	18.6	14	28.6	8	13.3	5	25.0	3	9.7	7	17.9
Total	199	100	49	100	60	100	20	100	31	100	39	100
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
SSS/SHS/VOCATION/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	1	3.2		
Total	200	100	49	100	60	100	20	100	31	100	40	100
MARITAL STATUS												
MARRIED	147	73.5	41	83.7	42	70.0	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	.5	0	0	1	1.7	0	0	0	0	4	10.0
WIDOWED	17	8.5	4	8.2	7	11.7	2	10.0	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	5.3	1	3.2	2	5.1
801-1000	5	2.6	2	4.1	0	0	0	0	0	0	0	0
ABOVE 1000	3	1.5	0	0	0	0	0	0	0	0	3	7.7
Total	196	100	49	100	58	100	19	100	31	100	39	100

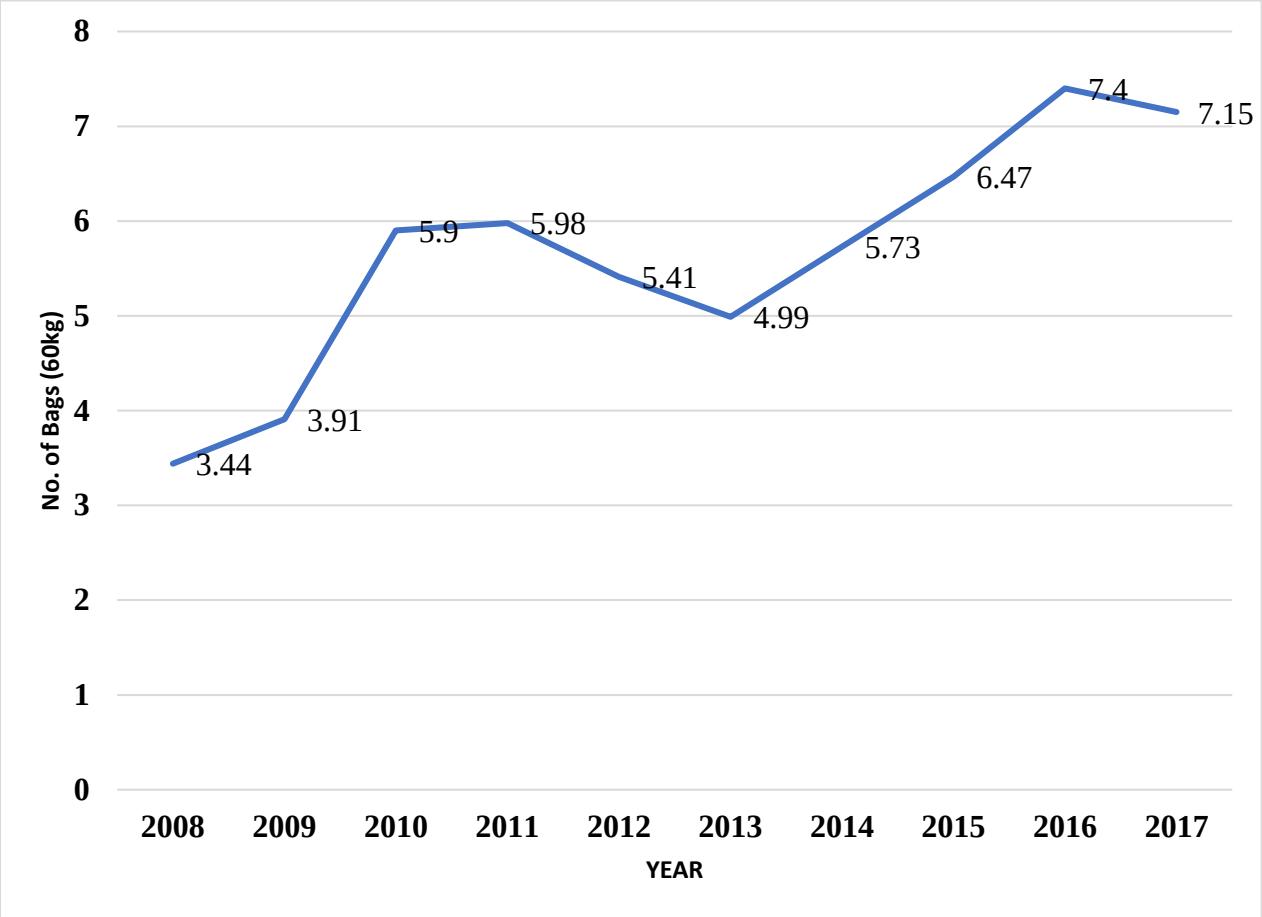
	TOTAL		KENYASI NO. 1		KENYASI NO. 2		KENYASI NO. 3		WAMAHINSO		NTOTROSO	
RELIGION												
	Freq	%	Freq	%	Freq	%	Freq	%	Freq.	%	Freq.	%
CHRISTIAN	167	87.0	43	87.8	49	90.7	16	84.2	26	83.9	33	84.6
MUSLIM	19	9.9	3	6.1	5	9.3	2	10.5	3	9.7	6	15.4
NO RELIGION	6	3.1	3	6.1	0	0	1	5.3	2	6.5	0	0
Total	192	100	49	100	54	100	19	100	31	100	39	100
MEMBERSHIP OF COCOA FARMER ORGANIZATION												
YES	91	51.7	20	43.5	18	39.1	8	50.0	16	55.2	29	74.4
NO	85	48.3	26	56.5	28	60.9	8	50.0	13	44.8	10	25.6
Total	176	100	46	100	46	100	16	100	29	100	39	100
HOUSEHOLD SIZE												
1-3	27	13.8	15	30.6	9	15.3	1	5.3	2	6.7	15	38.5
4-6	87	44.4	0	0	26	44.1	8	42.1	16	53.3	22	56.4
7-10	57	29.1	23	46.9	19	32.2	6	31.6	7	23.3	2	5.1
ABOVE 10	25	12.8	11	22.4	5	8.5	4	21.1	5	16.7		
Total	196	100	49	100	59	100	19	100	30	100	39	100
TOTAL SIZE OF COCOA FARMS												
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
>20	2	1.0	0	0	0	0	0	0	2	6.5	0	0
Total	200	100	49	100	60	100	20	100	31	100	40	100

Source: Fieldwork, 2018.

4.3 Trends in cocoa production among farmers in the study area

This section looks at trends in cocoa production in the study area. This considers the yearly trends in cocoa production from 2008 to 2018. The average cocoa produced per year is considered in this regard. It can be observed from Figure 4.1 that, the mean cocoa produced in 2008 was low with 4.70 bags per farmer. However, there was a rise to 6.11 in 2009, and another rise to 9.59 in 2010 after which there was a dip up to 2013. However, there was a rise again from 2014 to 2017.

Figure 4. 1: Record of cocoa production in the study communities



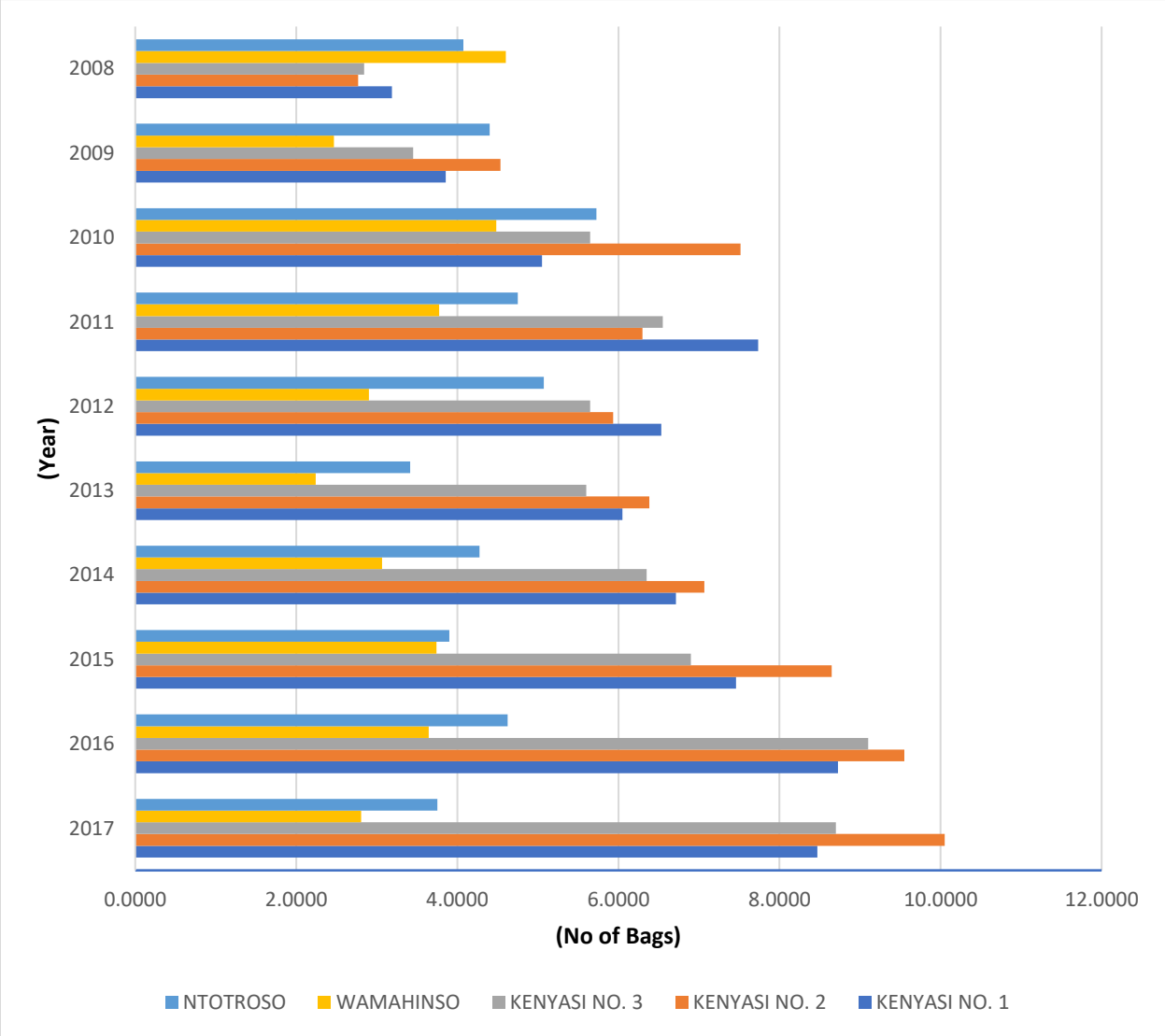
Source: Fieldwork, 2018.

Some respondents attributed the dip in cocoa yield to political reasons. To buttress this point, a respondent in Ntotroso 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 Ntotroso].

Also, a cross-tabulation between the communities and the average cocoa output per year was run. It emerged that, Kenyasi No. 2 had the leading output from 2013 up to 2017. Also, in 2009 and 2010, Kenyasi No. 2 had the highest cocoa output. Kenyasi No. 1 also had quite high output in most of the years apart from Kenyasi No. 1. This is shown in Figure 4.2.

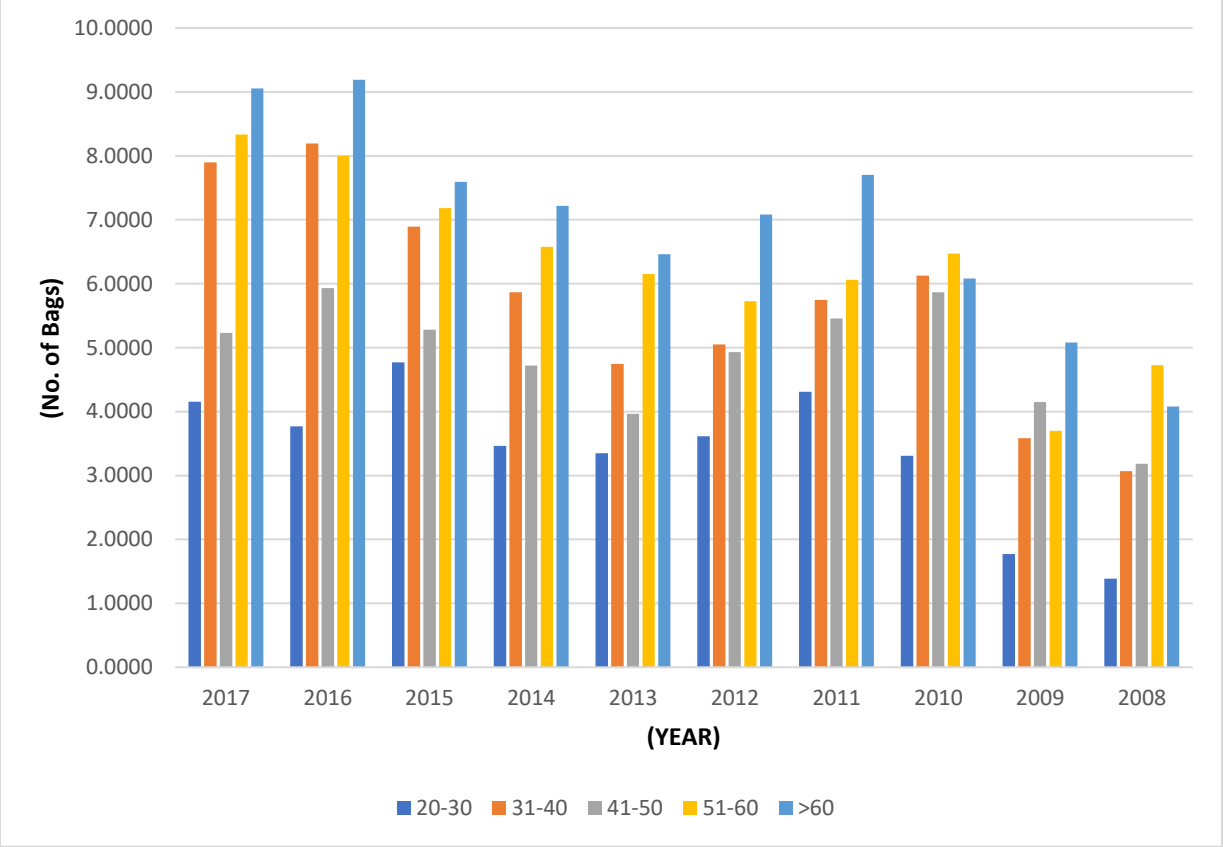
Figure 4. 2: Cross tab between cocoa yield and the study communities



Source: Fieldwork, 2018

Also, the study looked at the relationship between age and cocoa production. The data shows that farmers who are above the age of 60 years have more cocoa output per year compared to farmers with fewer ages. For instance, in 2017, those who are above the age of 60 produced an average of about 9 bags in the whole of that year, which is higher than the output of any other age category. The only instance where those in the above 60 age group did not produce the highest number of bags was in 2008 and 2010, where the highest output came from those between the ages of 50 and 60. This is shown in Figure 4.3.

Figure 4. 3: cross-tabulation between the age of farmers and cocoa production over a 10 year period



Source: Fieldwork, 2018.

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 (Table 4.2).

Table 4. 2: Crosstab between the level of education and cocoa production

	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 SCHOOL	5.88	6.20	5.51	5.17	4.52	4.94	5.61	5.63	3.72	3.45	5.06
SSS/SHS/VOCATIO N/TECHNICAL	17.44	16.22	13.89	11.11	9.67	8.00	8.00	5.00	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: Fieldwork, 2018

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 801and 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 were the highest income earners (4.47). this is shown in Table 4.3.

Table 4. 3: Crosstab between income and output of cocoa

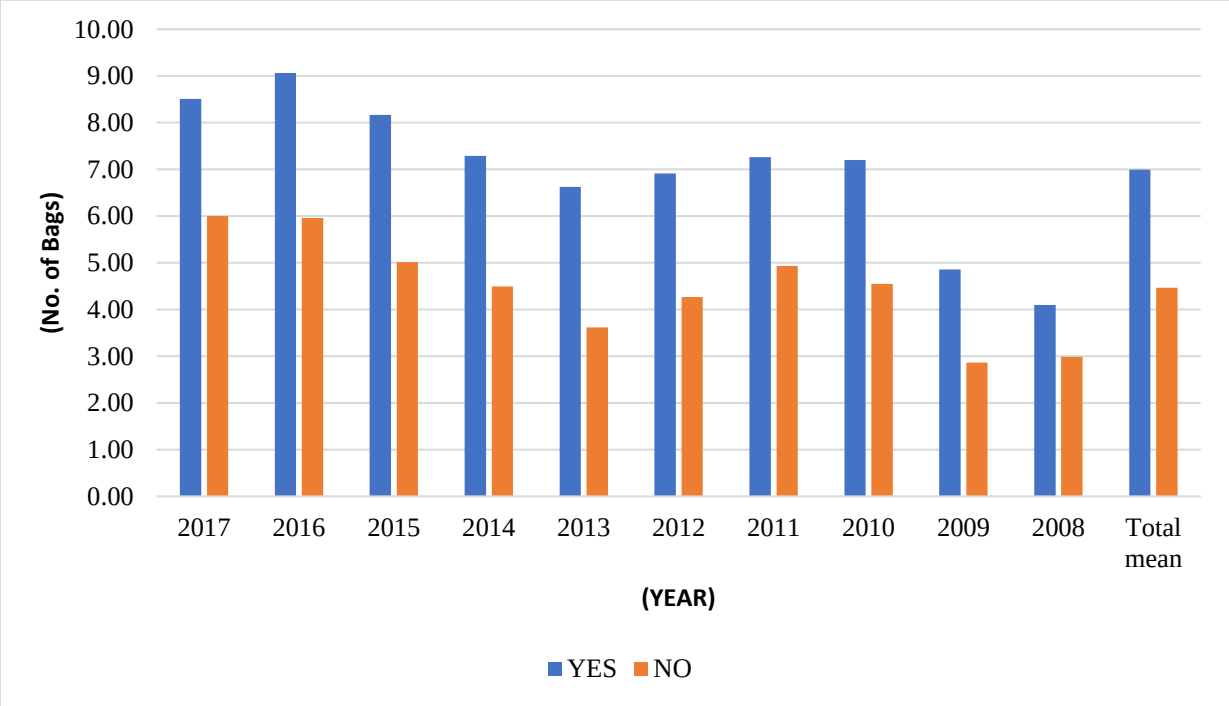
	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Total mean
BELOW 200	6.41	6.91	5.91	5.10	4.37	5.11	6.00	5.60	3.63	3.66	5.27
201-500	8.73	8.18	7.69	7.00	6.37	5.75	5.72	6.14	4.23	2.64	6.24
501-800	18.00	16.50	14.50	11.00	9.50	10.50	12.50	18.50	12.00	6.00	12.90
801-1000	9.60	11.60	11.40	10.00	9.80	9.20	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: Fieldwork, 2018

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 are not part of any farmer organization. For instance, on the average, whilst those who are part of farmer associations produced 7 bags, those who are not part of any farmer organization

produced 4.47 bags (Figure 4.4). This cut across all the various years with those belonging to farmer associations producer more.

Figure 4. 4: farmers' affiliation to associations and average cocoa production



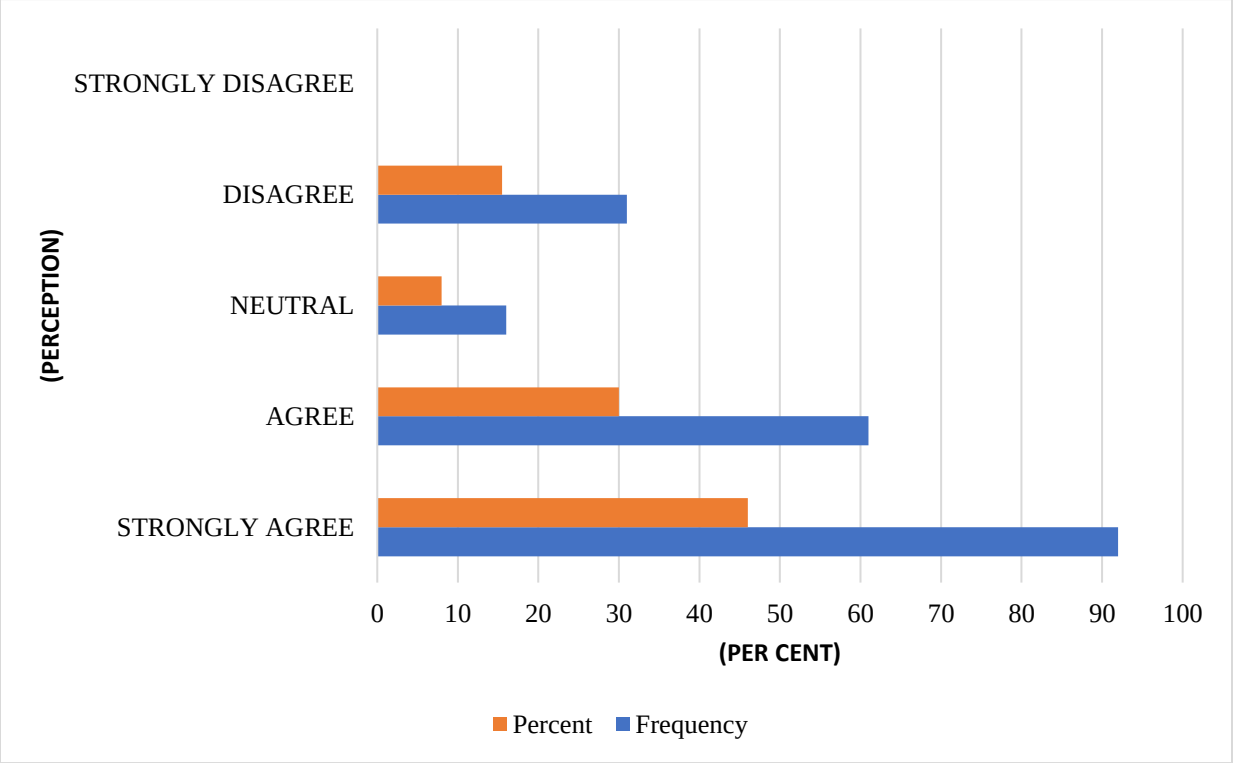
Source: Fieldwork, 2018

4.4 Farmers' perceptions of factors that influence Cocoa yield.

In order 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 of 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 an influence on the output of cocoa. The second-highest category of respondents who number up to 61 (30%) agreed that temperature affects the output of cocoa. Others also had neutral expression, and they were about 16 (8%) whilst 31 (15.5%) disagreed. None of the respondents strongly disagreed that temperature affects cocoa output.

Figure 4. 5: Perception of the impact of temperature on Cocoa yield



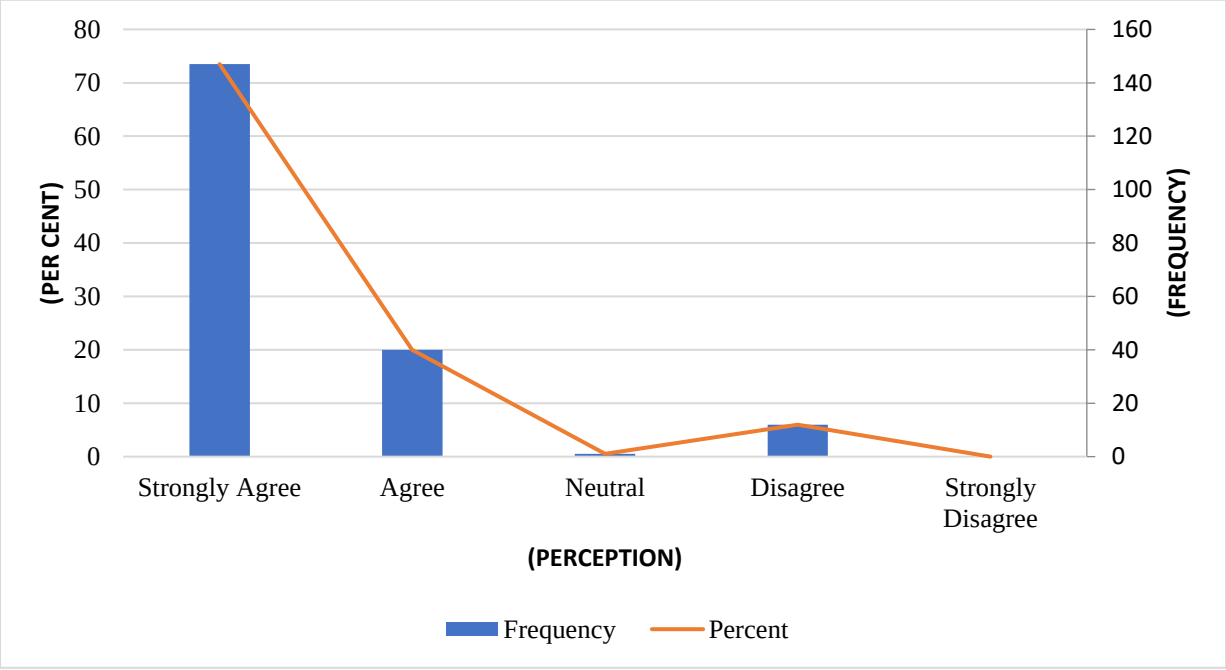
Source: Fieldwork, 2018

During the FGDs and interviews, it was revealed that although sunshine helps in the increase in cocoa yields, too much of it presents adverse effects on cocoa yield such as the cocoa tree bearing fewer fruits. Also, the cocoa leaves and roots become affected. Exactly what was said by a participant in an FGD is as follows:

> *…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 in reducing the impact of sunshine…* [FGD participant in Kenyasi No. 2.].

The next 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% remained neutral, whiles 0.5% remained neutral. None of the respondents strongly disagreed that rainfall affects temperature.

Figure 4. 6: Perception of rainfall as an influence on Cocoa output



Source: Fieldwork, 2018

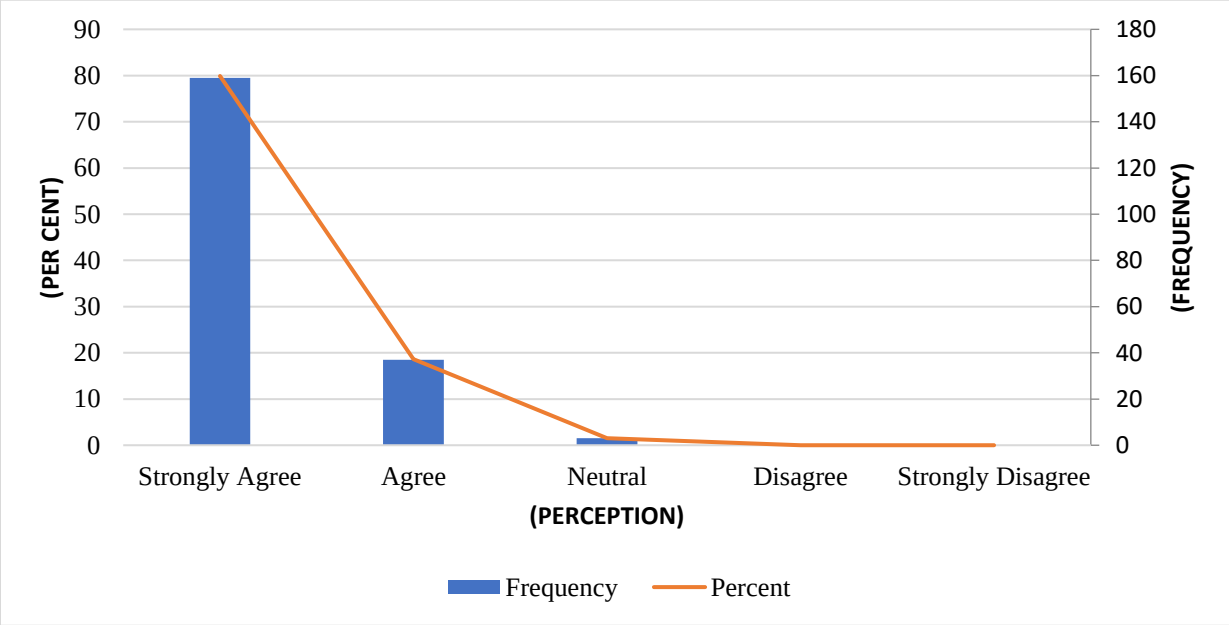
Rain or precipitation, like sunlight, promotes the yield of cocoa. However, farmers narrated that too much of rains/precipitation affect cocoa yield negatively. Too much rain can cause the cocoa

pods to rot, leading to losses. It also causes the branches to flourish, affecting the cocoa yields. From a farmer interviewed in Kenyasi No. 3 this is what he had this to say:

> *When it rains too much the cocoa pods rot… when there is too much rain or prolonged rainfall, l prune my cocoa farm every two weeks.* [Interview with a farmer in Kenyasi No. 3]

The next factor that was considered is pruning. With pruning as high as 150 (79.9%) of the respondents strongly agreed that it affects cocoa output followed by 37 (18.6%) of them who agreed. Only 3 (1.5%) remained neutral whilst none of them disagreed or strongly disagreed (Figure 4.7).

Figure 4. 7: Whether pruning affects cocoa production



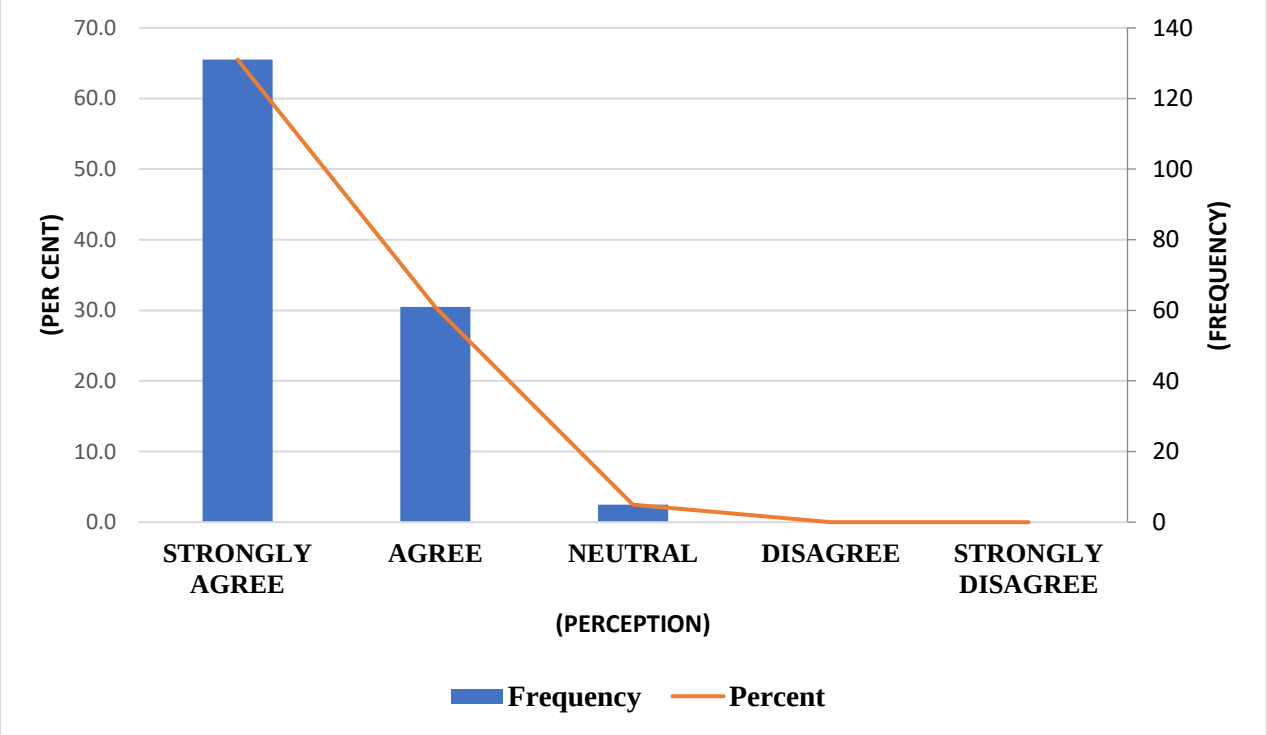
Source: Fieldwork, 2018

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 an 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 2.5% who remained neutral. None of the respondents disagreed or strongly disagreed (Figure 4.8).

Figure 4. 8: Use of hybrid seed as a factor that affects Cocoa output

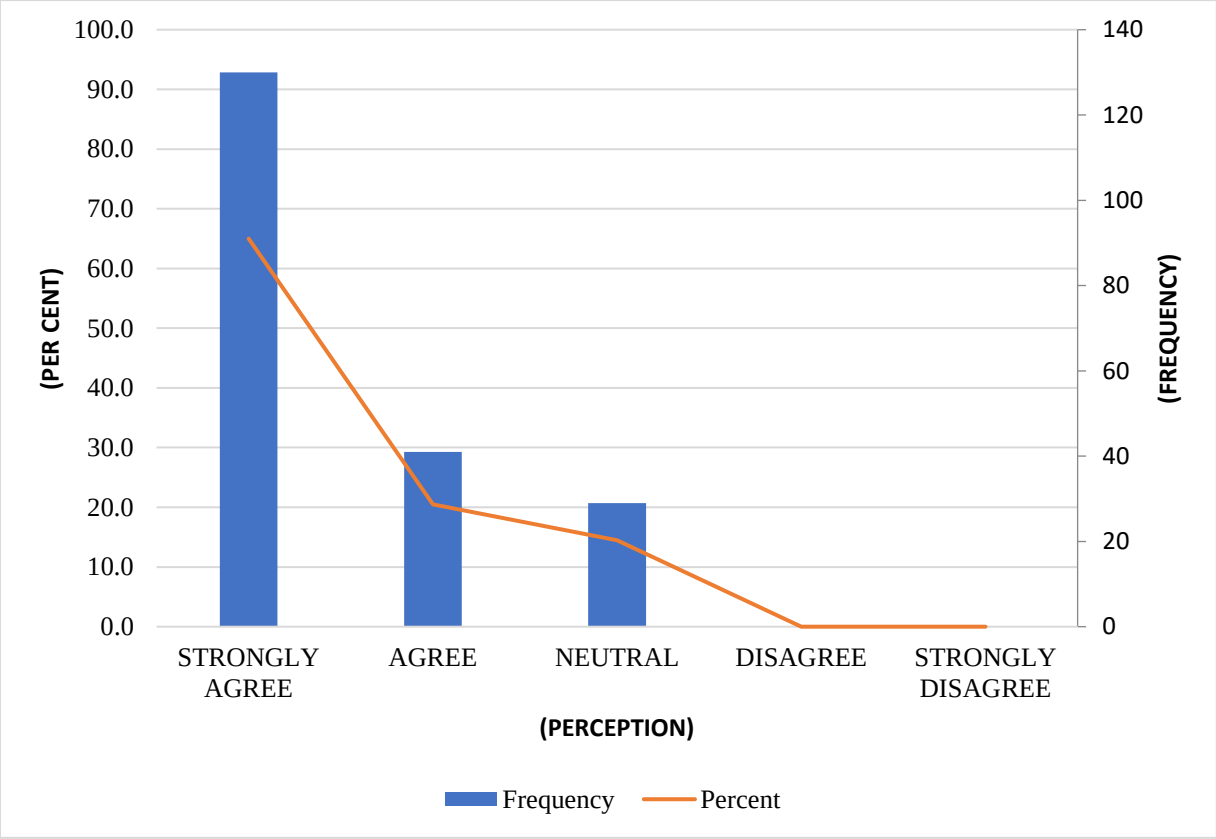


Source: Fieldwork, 2018

The study also considered another farm management practice and asked respondents their perception of it as a factor that influences cocoa production. It emerged that, one hundred and thirty (130) of the respondents representing 65% strongly agreed that applying fertilizer influences

cocoa production. Another forty-one (41) and twenty-nine (29) of the respondents representing 20.5% and 14.5% agreed and remained neutral, respectively. None of the respondents either disagreed or strongly disagreed that fertilizer influences crop production.

Figure 4. 9: Impact of fertilizer application on crop production

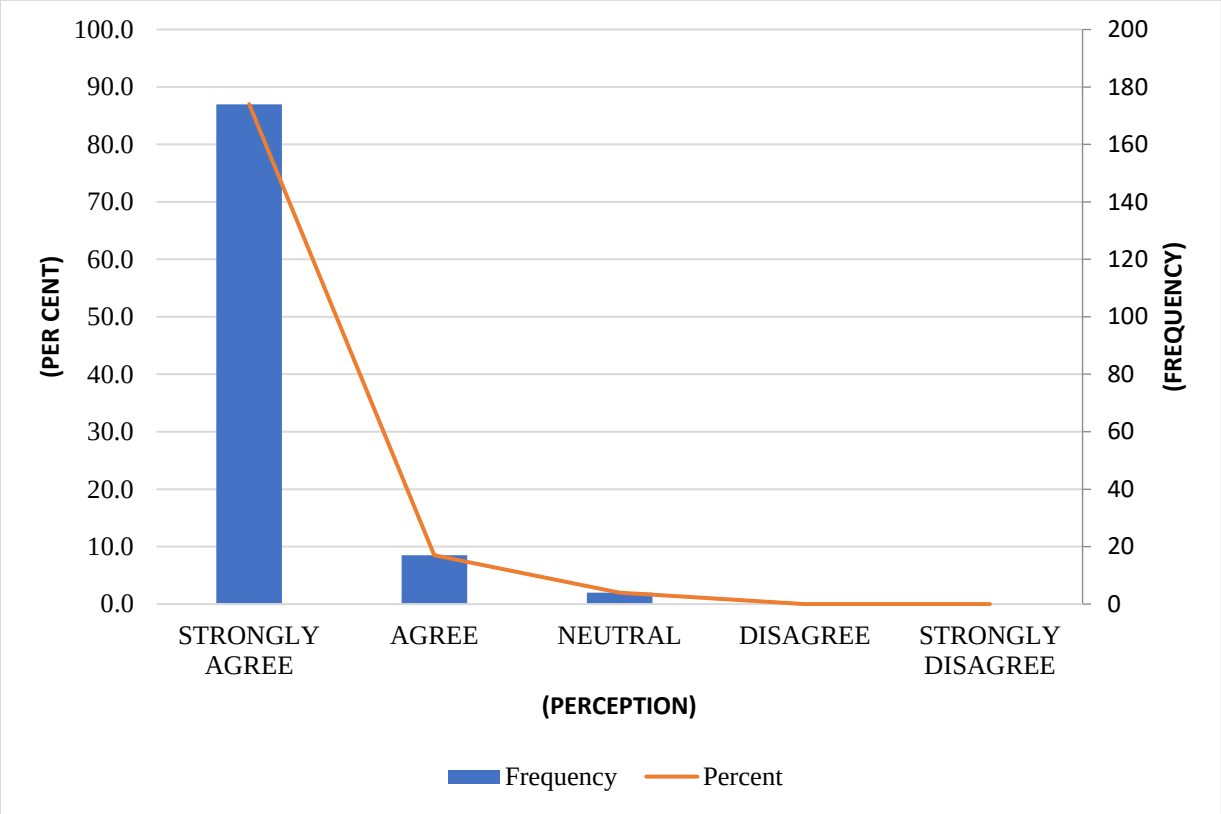


Source: Fieldwork, 2018

When it comes to the use of fungicides, the same trend ensued with one hundred and seventy-four (174) of the respondents representing a majority of 84% strongly agreeing that the application of fertilizer affects cocoa production. Another seventeen (17) of the respondents representing 8.5%

agreed whilst four (4) of them representing 2% remained neutral. Not surprisingly, none of the respondents either disagreed or strongly disagreed.

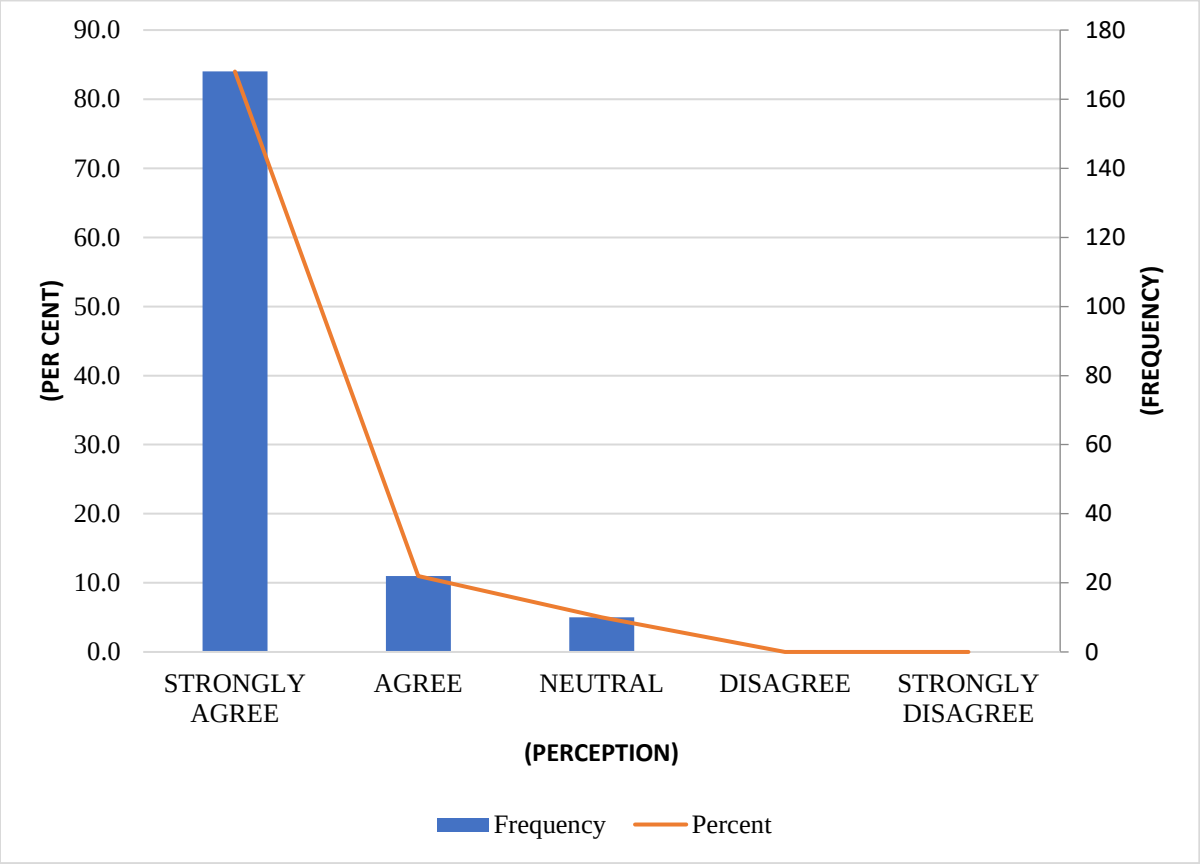
Figure 4. 10: The use of fungicides having an effect on cocoa yield



Source: Fieldwork, 2018.

Respondents were of similar perception when asked about the impact of the use of insecticide on cocoa yield. Ten of the respondents (10), representing 5% remained neutral, and twenty-two of them, representing 11% agreed. The remaining number of respondents who made up 84% strongly agreed that the use of insecticides affects cocoa yield.

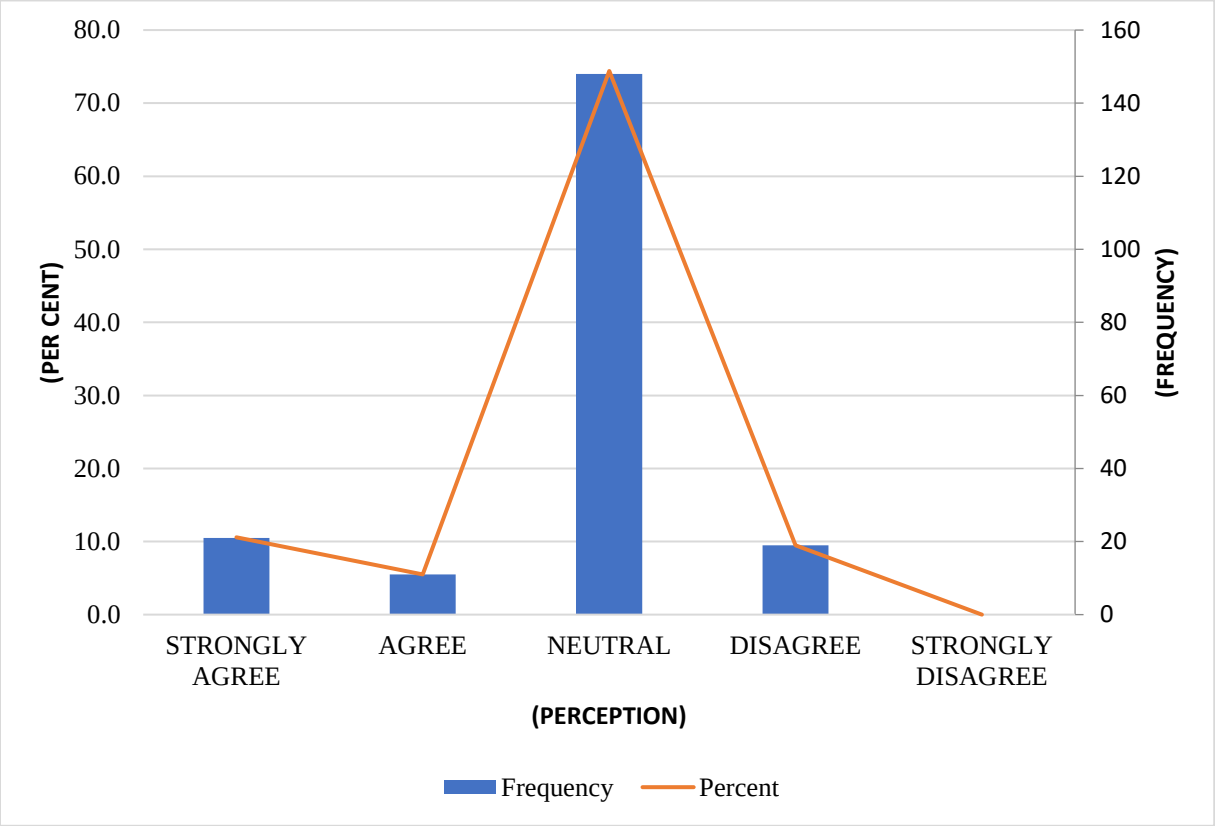
Figure 4. 11: Use of insecticides



Source: Fieldwork, 2018.

With irrigation, respondents were not quite sure about its effect on cocoa yield. This is evident in the results where one hundred and forty-eight (148) of them representing 74.4% remained neutral as to its effect on cocoa production. About 20 of them representing 10.6% strongly agreed that irrigation affects cocoa yield whilst another 5.5% agreed. Nineteen of the respondents representing 9.5%, however, disagreed that irrigation has any impact on cocoa yield.

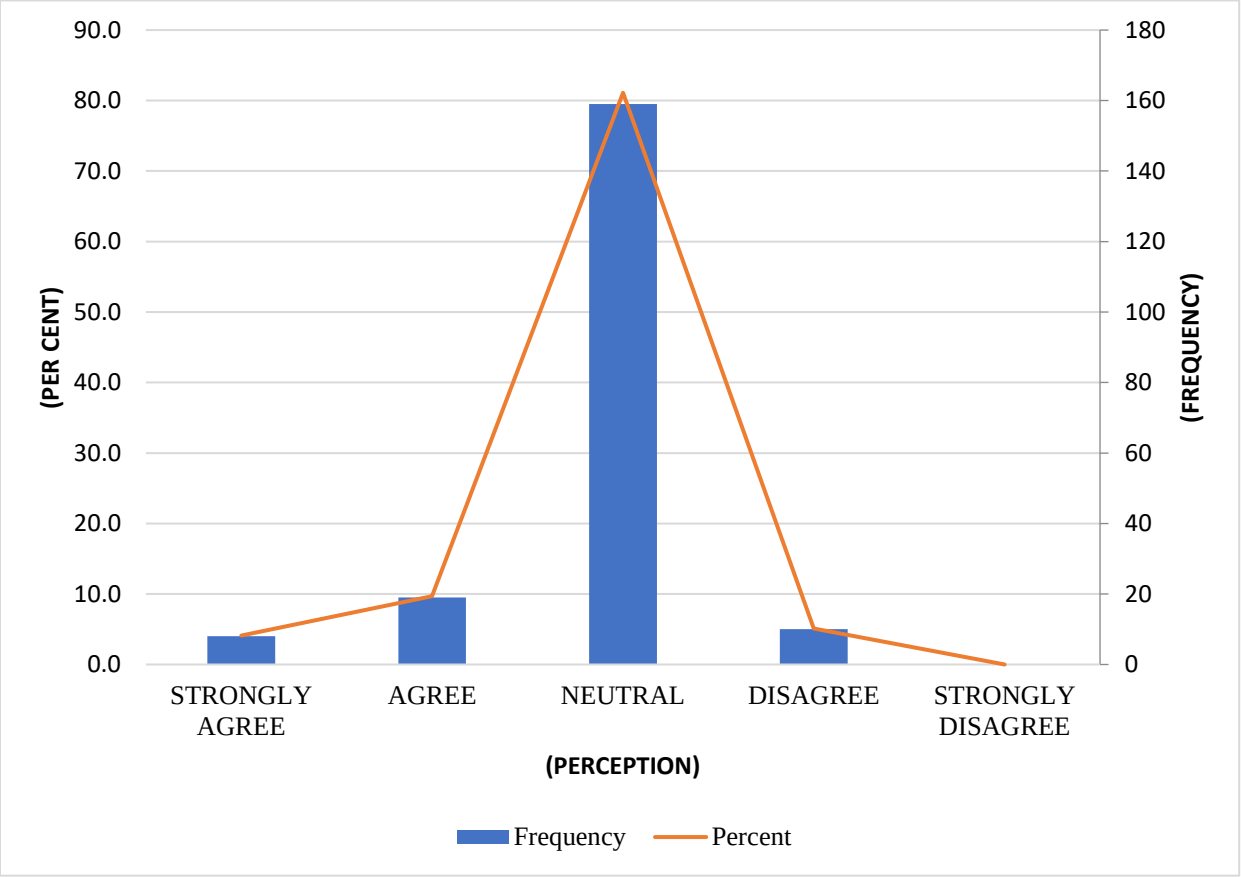
Figure 4. 12: Irrigation as an influence on cocoa yield



Source: Fieldwork, 2018.

A similar trend with irrigation was also revealed when respondents were asked whether planting of shade trees affect cocoa production. The results indicate that a majority of 81% remained neutral whilst 5.1% disagreed that shade trees have an influence on cocoa production. Those who agree made up of 9.7% whilst those who strongly agree were 4.1%. None of the respondents strongly disagreed.

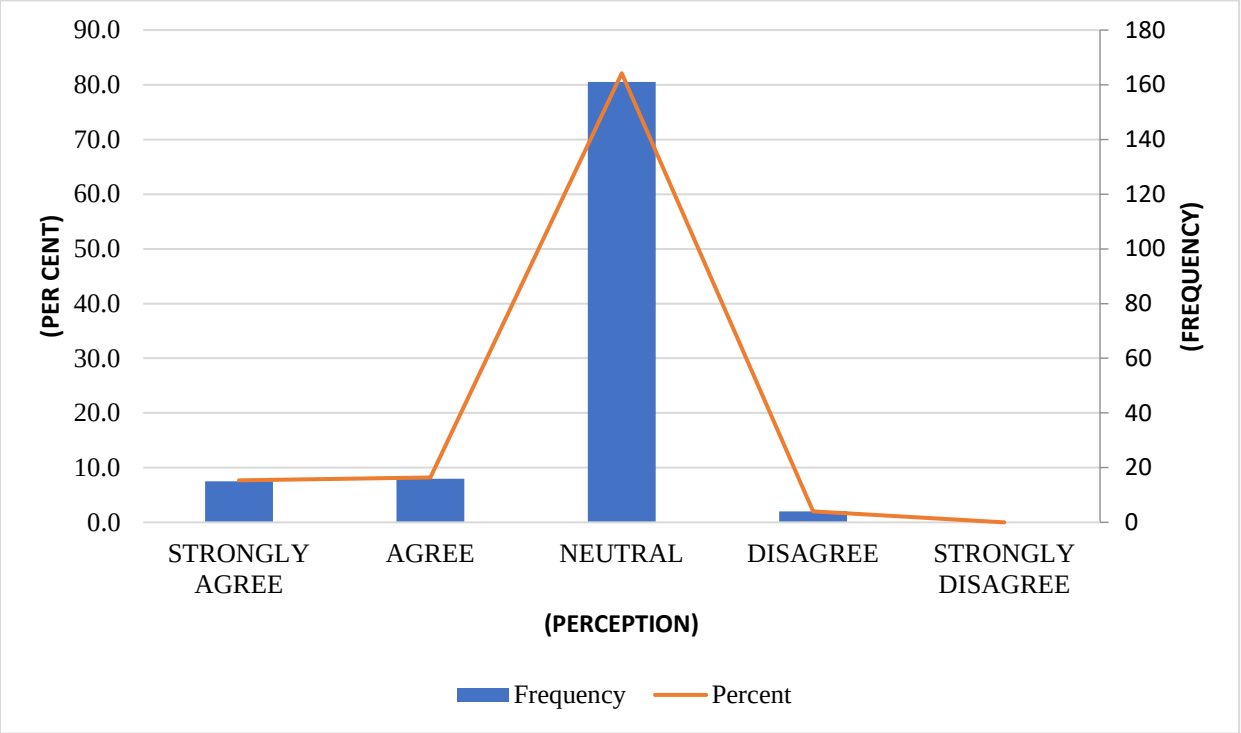
Figure 4. 13: Planting of shade trees



Source: Fieldwork, 2018.

The next factor that was looked at is the hand pollination exercise. This is quite new when it comes to cocoa farm management practices. It is therefore not surprising that the majority of respondents (82.1%) remained neutral on its influence on cocoa yield. However, as little as 2% disagreed whilst 8.2% agreed with 7.7% strongly agreeing that the hand pollination exercise affects cocoa yield.

Figure 4. 14: Influence of hand pollination on Cocoa yield



Source: Fieldwork, 2018

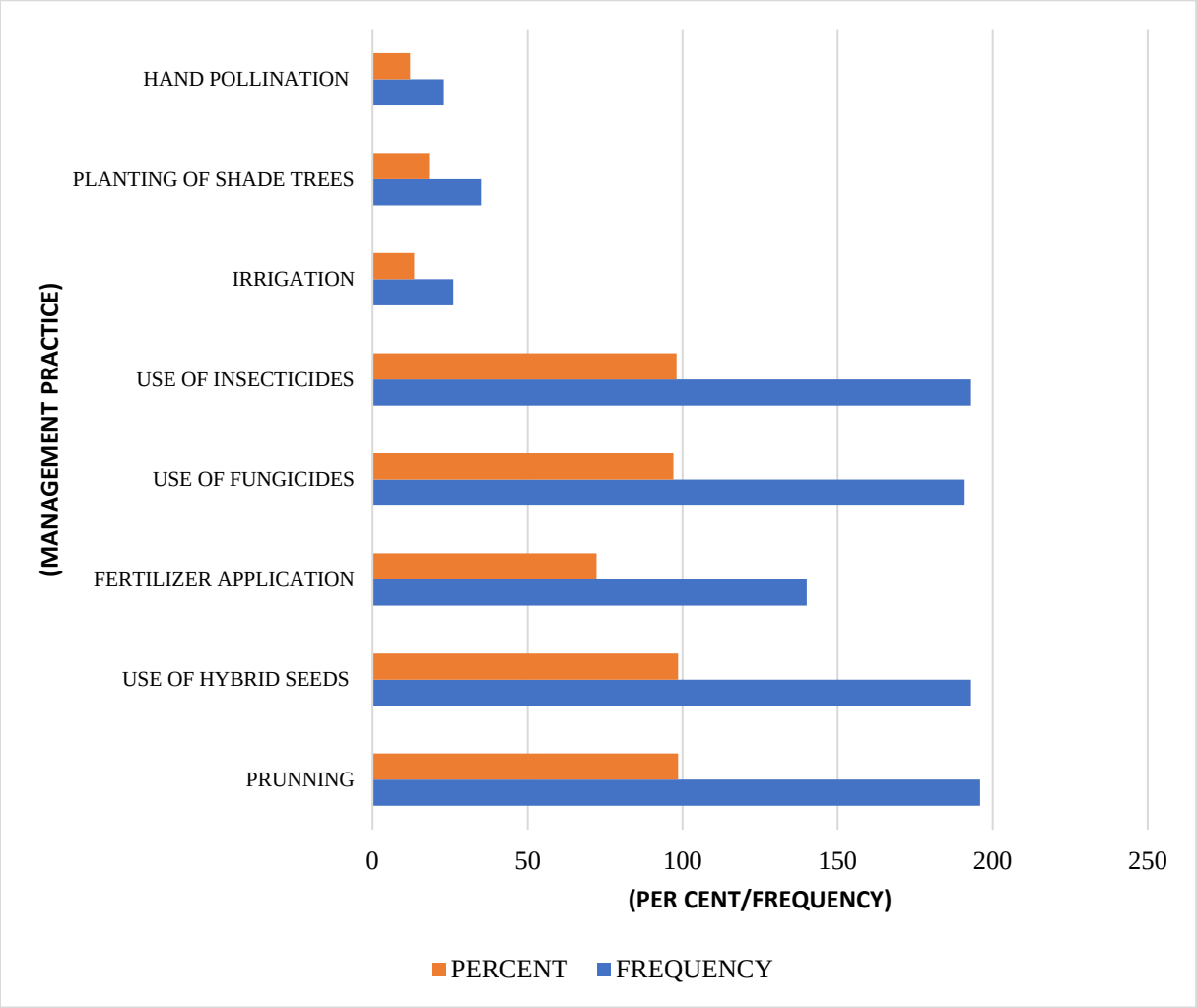
4.5 Farm management practices adopted by farmers and their influence on Cocoa yield

This section of the chapter looks at the 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 for 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 (Figure 4.15).

Figure 4. 15: Farm management practices by farmers

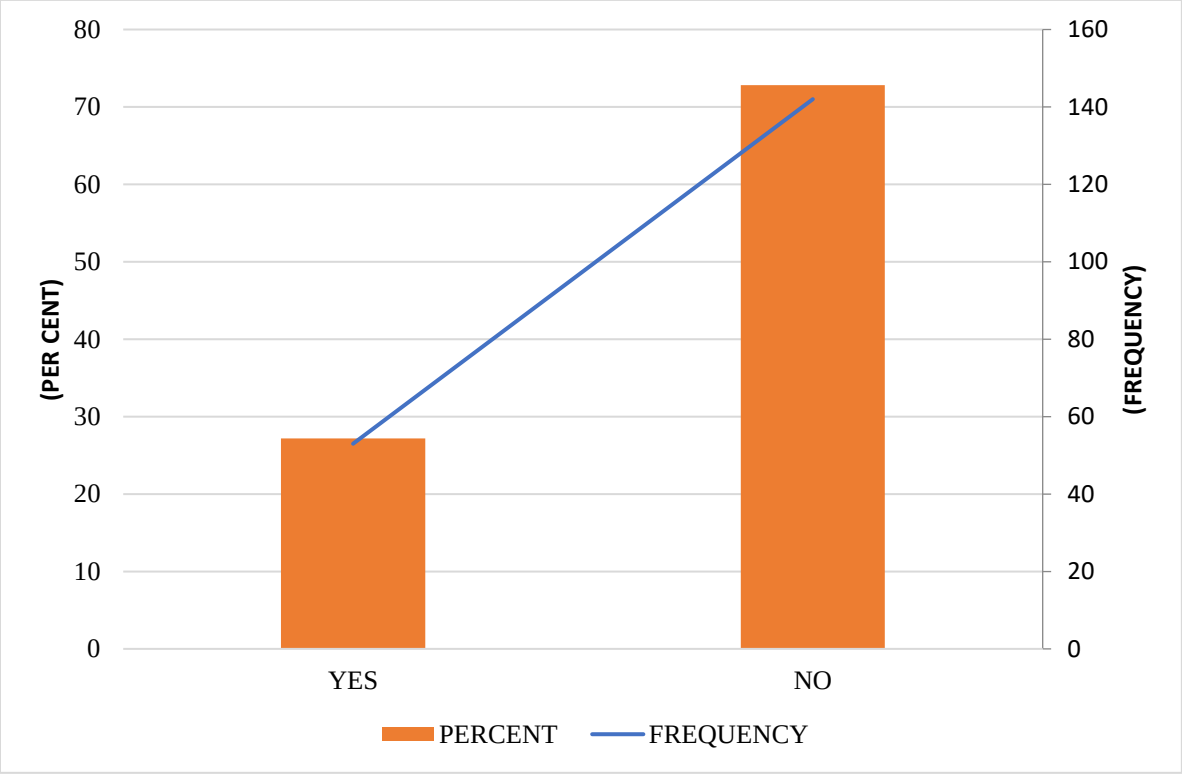


Source: Fieldwork, 2018.

The study also sought to find out whether farmers receive extension services. The results indicate that 142 of the respondents representing a majority of 72.8% do not receive extension services,

whiles the minority of 53 respondents representing 27.2% have access to extension services (Figure 4.16).

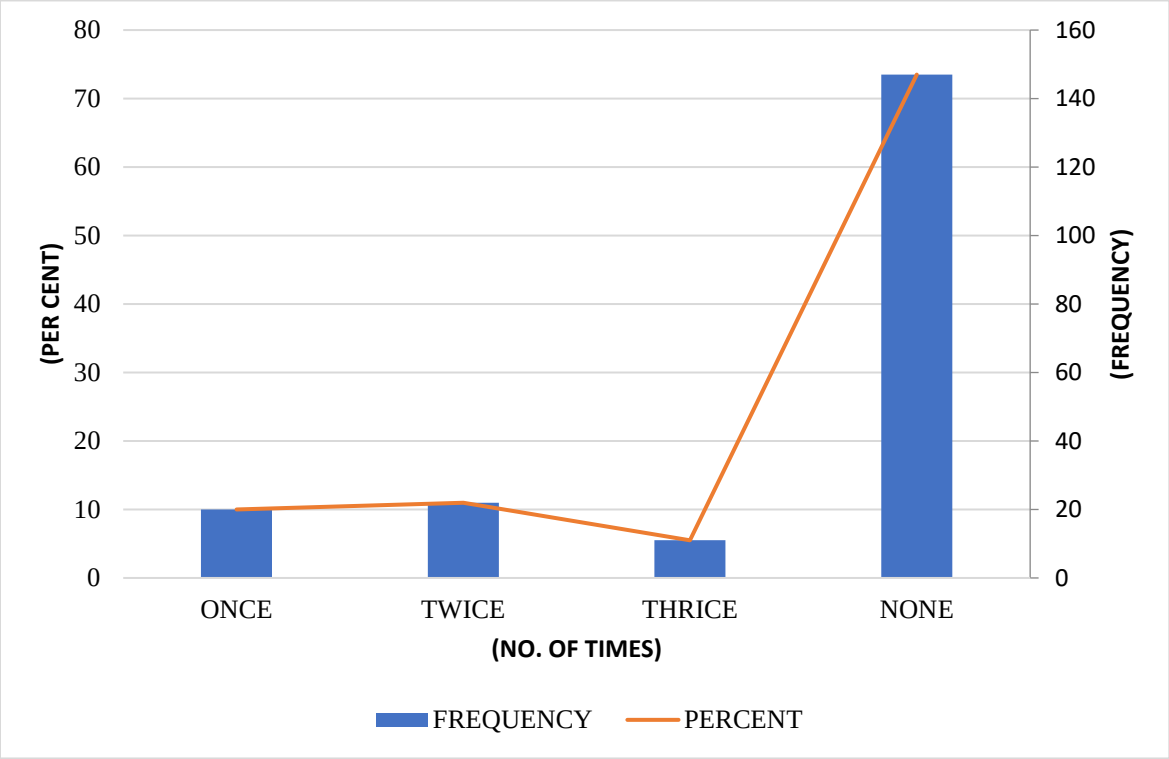
Figure 4. 16: Access to extension services



Source: Fieldwork, 2018

The study further went ahead to ask respondents how often extension officers visit their farm. The data indicate that a majority of 73.5% claim that no extension officers visit their farm at all. This is followed by 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 in a year (Figure 4.17).

Figure 4. 17: Frequency of visit by extension officers



Source: Fieldwork, 2018

In relation to the hypothesis, the study went ahead to look at the relationship between age, level of education and income of farmers and the kind of farm management practices they are engaged in. therefore, a Pearson chi-square test of independence was first run between the various age categories and the farm management practices.

The results indicate that with age, only the use of insecticide was significant. As shown in Table 4.4, the chi-square test of independence at a 5% level of significance is 0.005, which is less than the significant value of 0.05. This, therefore, means that the null hypothesis which states that there is no significant relationship between age and the use of insecticides cannot be accepted and the

alternate hypothesis which states that there is a significant relationship between age and the use of insecticides is accepted.

Table 4. 4: Crosstab of respondents' age and farm management practices

		20-30	31-40	41-50	51-60	ABOVE 60
PRUNNING	YES	13(100)	56(94.9)	56(100)	33(100)	37(100)
	NO	0(0)	3(5.1)	0(0)	0(0)	0(0)
	X^2	0.127				
	Pearson X^2	7.177				
USE OF HYBRID SEEDS	YES	13(100)	59(100)	52(98.1)	33(100)	35(94.6)
	NO	0(0)	0(0)	1(1.9)	0(0)	2(5.4)
	X^2	0.255				
	Pearson X^2	5.336				
FERTILIZER APPLICATION	YES	8(61.5)	38(69.1)	39(70.9)	21(63.6)	33(89.2)
	NO	5(38.5)	17(30.9)	16(29.1)	12(36.4)	4(10.8)
	X^2	0.110				
	Pearson X^2	7.540				
USE OF FUNGICIDES	YES	11(84.6)	57(96.6)	55(96.5)	30(00)	37(100)
	NO	2(15.4)	2(3.4)	2(3.5)	0(0)	0(0)
	X^2	0.066				
	Pearson X^2	8.829				
USE OF INSECTICIDES	YES	11(84.6)	59(100)	52(96.3)	33(100)	37(100)
	NO	2(15.4)	0(0)	2(3.7)	0(0)	0(0)
	X^2	0.005				
	Pearson X^2	15.013				
IRRIGATION	YES	1(7.7)	7(12.7)	9(16.4)	5(15.2)	3(8.1)
	NO	12(92.3)	48(87.3)	46(83.6)	28(84.8)	34(91.9)
	X^2	0.772				
	Pearson X^2	1.801				
PLANTING OF SHADE TREES	YES	0(0)	8(14.5)	7(13.2)	9(27.3)	10(27)
	NO	13(100)	47(85.5)	46(86.8)	24(72.7)	27(73)
	X^2	0.86				
	Pearson X^2	8.154				
HAND POLLINATION	YES	0(0)	7(12.7)	9(17.6)	2(6.1)	4(10.8)
	NO	13(100)	48(87.3)	42(82.4)	31(93.9)	33(89.2)
	X^2	4.589				
	Pearson X^2	0.332				

Source: Fieldwork, 2018

With respect to the level of education of cocoa farmers and the management practices they engage in the results indicate that there the use of fertilizer, insecticides and fungicides were significant with the level of education (Table 4.5).

Table 4. 5: Crosstab between the level of education and farm management practices

		No formal education	Primary	JHS/Middle	SHS/Voc/Tech	Tertiary
PRUNNING	YES	46(100)	36(100)	102(97.1)	9(100)	3(100)
	NO	0(0)	0(0)	3(2.9)	0(0)	0(0)
	X^2	2.727				
	Pearson X^2	0.605				
USE OF HYBRID SEEDS	YES	46(100)	36(100)	99(97.1)	9(100)	3(100)
	NO	0(0)	0(0)	3(2.9)	0(0.0)	0(0)
	X^2	2.808				
	Pearson X^2	0.591				
FERTILIZER APPLICATION	YES	36(81.8)	29(78.4)	73(69.5)	2(40)	0(0)
	NO	8(18.2)	8(21.6)	32(30.5)	3(60)	3(100)
	X^2	13.470				
	Pearson X^2	0.009				
USE OF FUNGICIDES	YES	41(95.3)	35(94.6)	105(100)	7(77.8)	3(100)
	NO	2(4.7)	2(5.4)	0(0)	2(22.2)	0(0)
	X^2	15.674				
	Pearson X^2	0.003				
USE OF INSECTICIDES	YES	44(95.7)	36(100)	103(100)	7(77.8)	3(100)
	NO	2(4.3)	0(0)	0(0)	2(22.2)	0(0)
	X^2	22.631				
	Pearson X^2	0.000				
IRRIGATION	YES	2(4.5)	6(16.2)	18(17.1)	0(0)	0(0)
	NO	42(95.5)	31(83.8)	87(82.9)	5(100)	3(100)
	X^2	5.730				
	Pearson X^2	0.220				
PLANTING OF SHADE TREES	YES	6(13)	11(30.6)	18(17.6)	0(0)	0(0)
	NO	40(87)	25(69.4)	84(82.4)	5(100)	3(100)
	X^2	6.306				
	Pearson X^2	0.177				
HAND POLLINATION	YES	4(9.1)	2(5.6)	17(16.7)	0(0)	0(0)
	NO	40(90.9)	34(94.4)	85(83.3)	5(100)	3(100)
	X^2	4.924				
	Pearson X^2	0.295				

Source: Fieldwork, 2018.

With respect to income, the study revealed that income levels are significant with the planting of shade trees and irrigation. As shown in Table 4.18, the Pearson Chi-square test value for the planting of shade trees and irrigation is 0.02 for both variables, which are lower than the significant value of 0.05. Therefore, the null hypothesis which states that there is no relationship between income and irrigation and planting of shade trees by farmers is rejected.

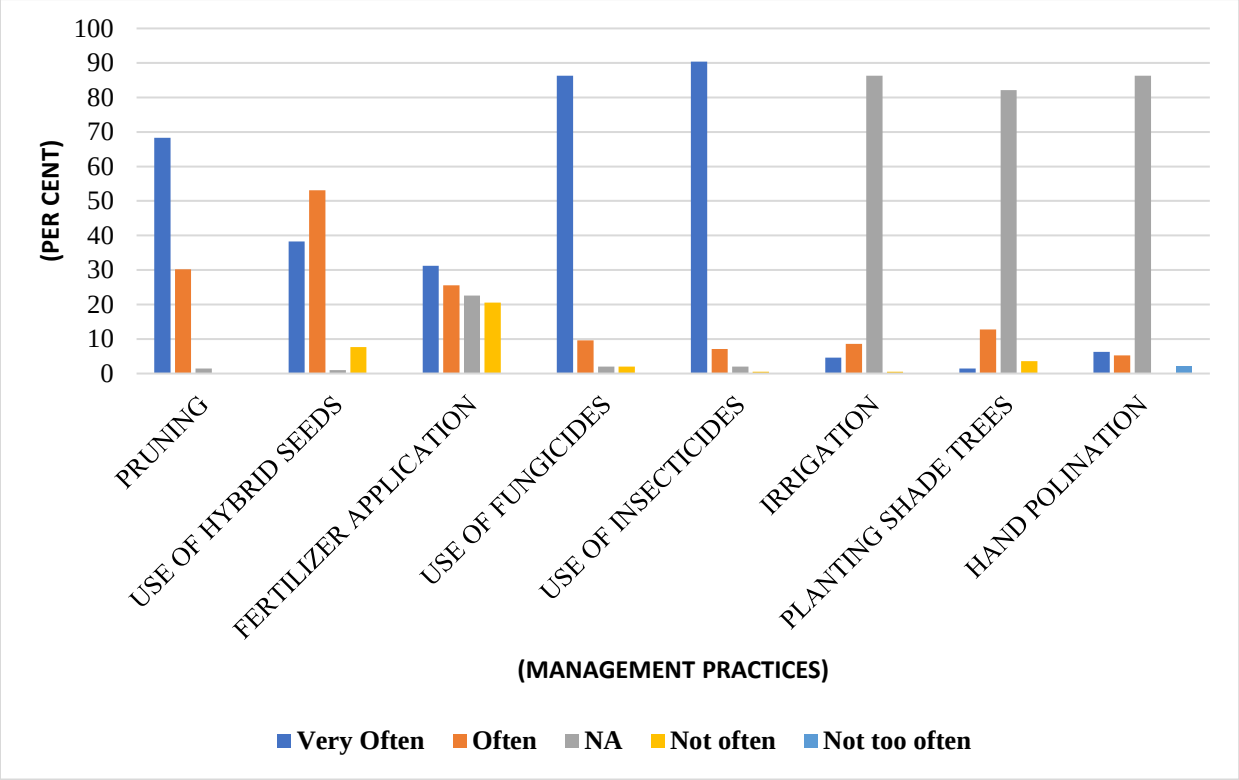
Table 4. 6: Income and farm management practices

		BELOW 200	201-500	501-800	801-1000	ABOVE 1000
PRUNNING	YES	131(97.8)	51(100)	2(100)	5(100)	3(100)
	NO	3(2.2)	0(0)	0(0)	0(0)	0(0)
	X^2	1.387				
	Pearson X^2	0.846				
USE OF HYBRID SEEDS	YES	131(99.2)	48(96.0)	2(100)	5(100)	3(100)
	NO	1(0.8)	2(4)	0(0)	0(0)	0(0)
	X^2	2.646				
	Pearson X^2	0.619				
FERTILIZER APPLICATION	YES	93(69.9%	33(70.2)	2(100)	5(100)	3(100)
	NO	40(30.1)	14(29.8)	0(0)	0(0)	0(0)
	X^2	4.193				
	Pearson X^2	0.381				
USE OF FUNGICIDES	YES	126(95.5)	51(100)	2(00)	5(100)	3(100)
	NO	6(4.5)	0(0)	0(0)	0(0)	0(0)
	X^2	2.862				
	Pearson X^2	0.581				
USE OF INSECTICIDES	YES	128(97)	51(100)	2(100)	5(100)	3(100)
	NO	4(3)	0(0)	0(0)	0(0)	0(0)
	X^2	1.888				
	Pearson X^2	0.756				
IRRIGATION	YES	11(8.3)	11(23.4)	0(0)	2(40)	2(66.7)
	NO	122(91.7)	36(76.6)	2(100)	3(60)	1(33.3)
	X^2	17.438				
	Pearson X^2	0.002				
PLANTING OF SHADE TREES	YES	19(14.4)	12(26.1)	0(0)	4(80)	0(0)
	NO	113(85.6)	34(73.9)	2(100)	1(20)	3(100)
	X^2	16.826				
	Pearson X^2	0.002				
HAND POLLINATION	YES	16(12.3)	6(13)	0(0)	1(20)	0(0)
	NO	114(87.7)	40(87)	2(100)	4(80)	3(100)
	X^2	0.994				
	Pearson X^2	0.911				

Source: Fieldwork, 2018

The study went on to look at the rate at which farmers engage in these farm management practices. The results indicate the respondents, very often practice the application of fungicides, insecticides and prune their cocoa trees. However, respondents did not engage in the planting of shade trees or practised irrigation and hand pollination exercises (Figure 4.18).

Figure 4. 18: Rate of engaging in farm management practices



Source: Fieldwork, 2018.

The study explored how age can be a factor in the practice of the farm management practices identified. It was revealed that only 5.1% of those in the 31-40-year group did not engage in pruning whilst all the other age groups either practised pruning often or very often. With the use of hybrid seeds, there was representation for those above the age of 31 who said they do not use

hybrid seeds often. Majority of respondents between the ages of 20-30 indicated that they use fertilizer very often, which represents the highest of all age categories. With the planting of shade trees and the engagement in hand pollination exercise, an overwhelming majority of more than about 90% of all age categories did not engage in those exercises whilst the use of fungicides and insecticides received very often usage or practice among the respondents (Table 4.7).

Table 4. 7: Age and rate of engaging in farm management practices

		20-30	**31-40**	**41-50**	**51-60**	**ABOVE 60**
PRUNING	Very often	11(84.6)	44(74.6)	42(75)	16(48.5)	23(62.2)
	Often	2(15.4)	12(20.3)	14(25)	17(51.5)	14(37.8)
	NA	0(0)	3(5.1)	0(0)	0(0)	0(0)
	Not often	0(0)	0(0)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
USE OF HYBRID SEEDS	Very often	8(61.5)	20 (33.9)	17(32.1)	12(36.4)	18(48.6)
	Often	20(33.9)	32 (54.2)	32(60.4)	20(60.6)	14(37.8)
	NA	0(0)	1(1.7)	1(1.9)	0(0)	0(0)
	Not often	0(0)	6(10.2)	3(5.7)	1(3)	5(13.5)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
FERTILIZER APPLICATION	Very often	8(66.7)	16(27.1)	17(29.8)	6(18.2)	14(37.8)
	Often	0(0)	7(11.9)	17(29.8)	12(36.4)	15(40.5)
	NA	4(33.3)	14(23.7)	13(22.8)	9(27.3)	5(13.5)
	Not often	0(0)	22(37.3)	10(17.5)	6(18.2)	3(8.1)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
USE OF FUNGICIDES	Very often	7(58.3)	50(84.7)	46(83.6)	30(90.9)	37(100)
	Often	0(0)	9(15.3)	6(10.9)	3(9.1)	0(0)
	NA	2(16.7)	0(0)	2(3.6)	0(0)	0(0)
	Not often	3(25)	0(0)	1(1.8)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)

		20-30	31-40	41-50	51-60	ABOVE 60
USE OF INSECTICIDES	Very often	10(76.9)	52(88.1)	51(92.7)	29(87.9)	37(100)
	Often	0(0)	2(3.6)	2(3.6)	4(12.1)	0(0)
	NA	2(15.4)	2(3.6)	2(3.6)	0(0)	0(0)
	Not often	1(7.7)	0(0)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
IRRIGATION	Very often	0(0)	0(0)	6(11.1)	2(6.1)	1(2.7)
	Often	1(7.7)	3(5.1)	5(9.3)	5(5.4)	2(5.4)
	NA	12(92.3)	56(94.9)	43(79.6)	34(91.9)	34(91.9)
	Not often	0(0)	0(0)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
PLANTING OF SHADE TREES	Very often	0(0)	0(0)	3(5.6)	0(0)	0(0)
	Often	0(0)	7(11.9)	3(5.6)	4(12.1)	10(27)
	NA	12(100)	48(81.4)	48(88.9)	26(78.8)	27(73)
	Not often	0(0)	4(6.8)	0(0)	3(9.1)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
HAND POLLINATION	Very often	0(0)	5(8.8)	3(6)	2(6.1)	2(5.4)
	Often	0(0)	2(3.5)	5(10)	0(0)	2(5.4)
	NA	12(100)	46(80.7)	42(84)	31(93.9)	33(89.2)
	Not often	0(0)	4(7)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)

Source: Fieldwork, 2018

The study also explored the level of education of farmers and the rate at which they undertake certain farm management practices. The results, as shown in Table 4.8 reveal that the majority of respondents in all education levels with the exception of those who attended SSS/Voc/Tech practice pruning very often. In terms of the use of hybrid seeds, it is only those who attended middle school and tertiary where 1% and 33% respectively indicated that they do not use hybrid seeds. Whilst all the other age groups had a large majority using fungicides, those who have had education at the SSS level and above had minority agreeing that they use fungicides very often.

Also, it is only those who have attained education up to the SSS level that had minority indicating that they use insecticides very often. The results showed that it is only irrigation, hand pollination and planting of shade trees that majority of respondents from all levels of education indicated that they do not practice them (Table 4.8).

Table 4. 8: Level of education and rate of engaging in farm management practices

		No Formal Education	**Primary**	**JHS/Middle School**	**SSS/Voc/Tech**	**Tertiary**
PRUNING	Very often	37(80.4)	18(50)	75(71.4)	4(44.4)	2(66.7)
	Often	9(19.6)	18(50)	27(25.7)	5(55.6)	1(33.3)
	NA	0(0)	0(0)	3(2.9)	0(0)	0(0)
	Not often	0(0)	0(0)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
USE OF HYBRID SEEDS	Very often	20(45.5)	16(44.4)	34(32.7)	4(4.4)	1(33.3)
	Often	24(54.5)	19(52.8)	59(56.7)	1(11.1)	1(33.3)
	NA	0(0)	0(0)	1(1)	0(0)	1(33.3)
	Not often	0(0)	0(0)	10(9.6)	4(44.4)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
FERTILIZER APPLICATION	Very often	18(39.1)	9(24.3)	32(30.8)	2(22.2)	1(33.3)
	Often	13(28.3)	15(40.5)	23(22.1)	0(0)	0(0)
	NA	9(19.6)	5(13.5)	22(21.1)	7(77.8)	2(66.7)
	Not often	6(13)	8(21.6)	27(26)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
USE OF FUNGICIDES	Very often	39(88.6)	33(89.2)	92(88.5)	3(33.3)	3(33.3)
	Often	2(4.5)	4(10.8)	9(8.7)	4(44.4)	4(44.4)
	NA	2(4.5)	0(0)	0(0)	2(22.2)	2(22.2)
	Not often	1(2.3)	0(0)	3(2.9)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)

		No Formal Education	Primary	JHS/Middle School	SSS/Voc/Tech	Tertiary
USE OF INSECTICIDES	Very often	40(87)	34(94.4)	99(95.2)	3(33.3)	3(100)
	Often	4(8.7)	2(5.6)	4(3.8)	4(44.4)	0(0)
	NA	2(4.3)	0(0)	0(0)	2(22.2)	0(0)
	Not often	0(0)	0(0)	1(1)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
IRRIGATION	Very often	0(0)	3(8.1)	6(5.8)	0(0)	0(0)
	Often	6(13.6)	2(5.4)	9(8.7)	0(0)	0(0)
	NA	38(86.4)	32(86.5)	88(84.6)	9(100)	3(100)
	Not often	0(0)	0(0)	1(1)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
PLANTING OF SHADE TREES	Very often	2(4.3)	0(0)	1(1)	0(0)	0(0)
	Often	4(8.7)	11(30.6)	10(9.8)	0(0)	0(0)
	NA	40(87)	25(69.4)	88(86.3)	5(55.6)	3(100)
	Not often	0(0)	0(0)	3(2.9)	4(44.4)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
HAND POLLINATION	Very often	0(0)	0(0)	12(12.2)	0(0)	0(0)
	Often	6(13.6)	2(5.6)	2(2)	0(0)	0(0)
	NA	38(86.4)	34(94.4)	84(85.7)	5(55.6)	3(100)
	Not often	0(0)	0(0)	0(0)	4(44.4)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)

Source: Fieldwork, 2018

In terms of income, the study revealed that all those with incomes above GHC 800 do not practice pruning and hybrid seeds very often. All of the respondents with an income of above GHC 500 engage in fertilizer application on their cocoa farm. With the exception of those within the income bracket of less than GHC 200, almost all the respondents use fungicides very often. This is similar to the use of insecticides. With respect to irrigation, planting of shade trees and hand pollination exercises, there was poor usage from the respondents across all the age categories.

Table 4. 9: Income and rate of engaging in farm management practices

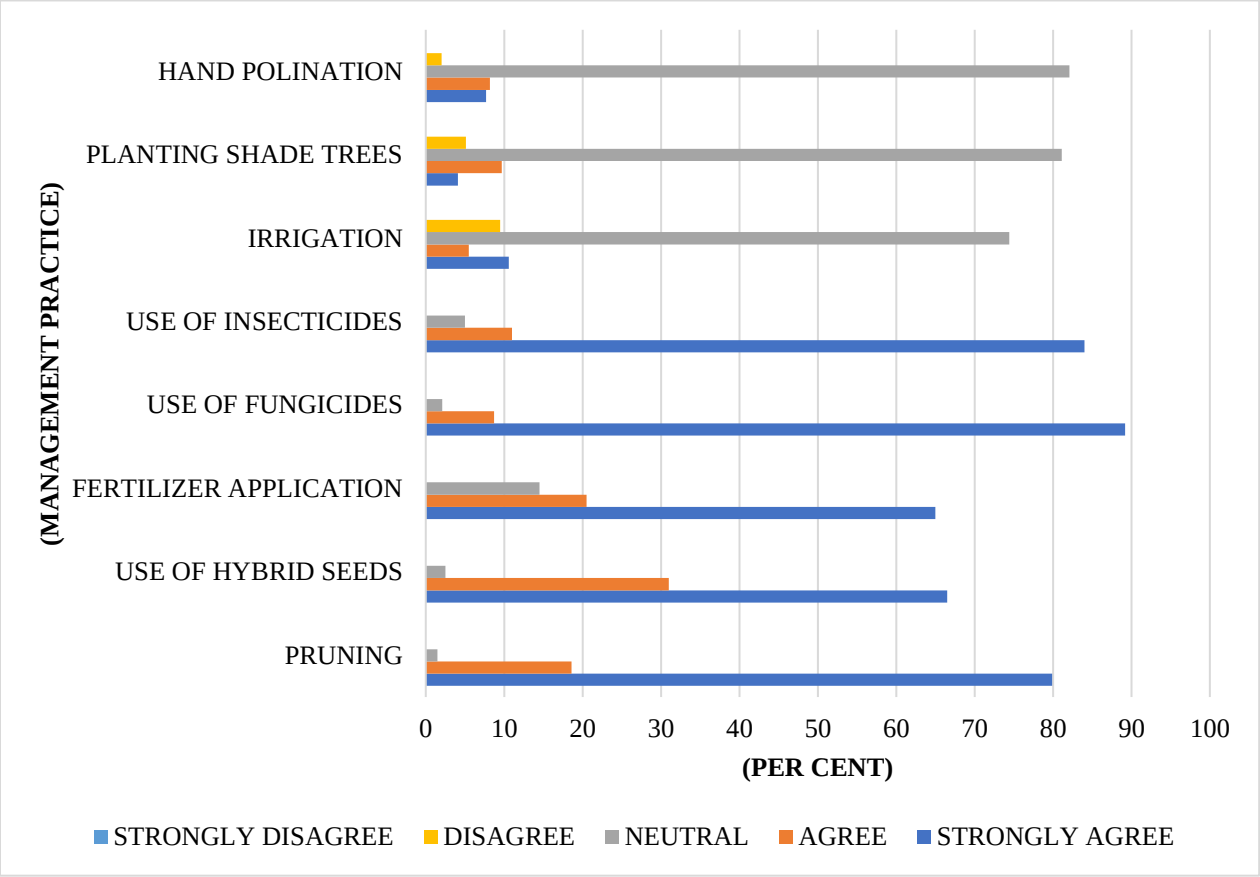
		BELOW 200	201-500	501-800	801-1000	ABOVE 1000
PRUNNING	Very often	94(70.1)	36(70.6)	2(100)	0(0)	0(0)
	Often	37(27.6)	15(29.4)	0(0)	5(100)	3(100)
	NA	3(2.2)	0(0)	0(0)	0(0)	0(0)
	Not often	0(0)	0(0)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
USE OF HYBRID SEEDS	Very often	61(46.2)	13(26)	1(50)	0(0)	0(0)
	Often	68(51.5)	29(58)	1(50)	2(40)	0(0)
	NA	2(1.5)	0(0)	0(0)	0(0)	0(0)
	Not often	1(0.8)	8(16)	0(0)	3(60)	3(100)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
FERTILIZER APPLICATION	Very often	50(37.3)	7(13.7)	1(50)	2(40)	1(33.3)
	Often	33(24.6)	16(31.4)	1(50)	0(0)	1(33.3)
	NA	35(26.1)	10(19.6)	0(0)	0(0)	0(0)
	Not often	16(11.9)	18(35.3)	0(0)	3(60)	1(33.3)
	Not too often	0(0)	0(0)	0(0)	1(33.3)	0(0)
USE OF FUNGICIDES	Very often	115(87.1)	43(84.3)	2(100)	4(80)	2(66.7)
	Often	9(6.8)	8(15.7)	0(0)	1(20)	1(33.3)
	NA	4(3)	0(0)	0(0)	0(0)	0(0)
	Not often	4(3)	0(0)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
USE OF INSECTICIDES	Very often	120(89.6)	46(92)	2(100)	4(80)	3(100)
	Often	9(6.7)	4(8)	0(0)	1(20)	0(0)
	NA	4(3)	0(0)	0(0)	0(0)	0(0)
	Not often	1(0.7)	0(0)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)

		BELOW 200	**201-500**	**501-800**	**801-1000**	**ABOVE 1000**
IRRIGATION	Very often	4(3)	3(5.9)	0(0)	1(20)	0(0)
	Often	8(6.1)	8(15.7)	0(0)	1(20)	0(0)
	NA	119(90.2)	40(78.4)	2(100)	3(60)	0(0)
	Not often	1(0.8)	0(0)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
PLANTING OF SHADE TREES	Very often	2(1.5)	1(2)	0(0)	0(0)	0(0)
	Often	11(8.3)	10(20)	0(0)	4(80)	0(0)
	NA	116(87.9)	35(70)	2(100)	1(20)	3(100)
	Not often	3(2.3)	4(8)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)
HAND POLLINATION	Very often	10(7.8)	2(4.2)	0(0)	0(0)	0(0)
	Often	8(46.3)	1(2.1)	0(0)	1(20)	0(0)
	NA	110(85.9)	41(85.4)	2(100)	4(80)	3(100)
	Not often	0(0)	4(8.3)	0(0)	0(0)	0(0)
	Not too often	0(0)	0(0)	0(0)	0(0)	0(0)

Source: Fieldwork, 2018

The study went further to assess respondents' perception of the impacts these farm management practices have on the yield of cocoa. The results show that respondents did not know or had no idea on the impact of hand pollination, planting of shade trees and irrigation on the yield of cocoa. However, the majority of them in all cases strongly agreed to the use of insecticides, fungicides, fertilizer, hybrid seeds, and practising pruning as increasing cocoa yield (Figure 4.19).

Figure 4. 19: Farm management practice lead to an increase in cocoa yield



Source: Fieldwork, 2018

During the interviews and FGDs, it was revealed that some of the respondents do not practice irrigation and hand pollination exercises because they believed those management practices had little/no effect on the output of cocoa. They indicated that although they have seen a group of government employees moving from farm to farm to do hand pollination, they are yet to know of the level of its benefits. However, in the case of planting shade trees, respondents indicated that the current breed of cocoa seeds do not require the planting of shade trees in order to get more yield. With or without shade trees, the cocoa trees continue to do well by giving off the yields they expect. In the case of the other farm management practices however, respondents were of a strong

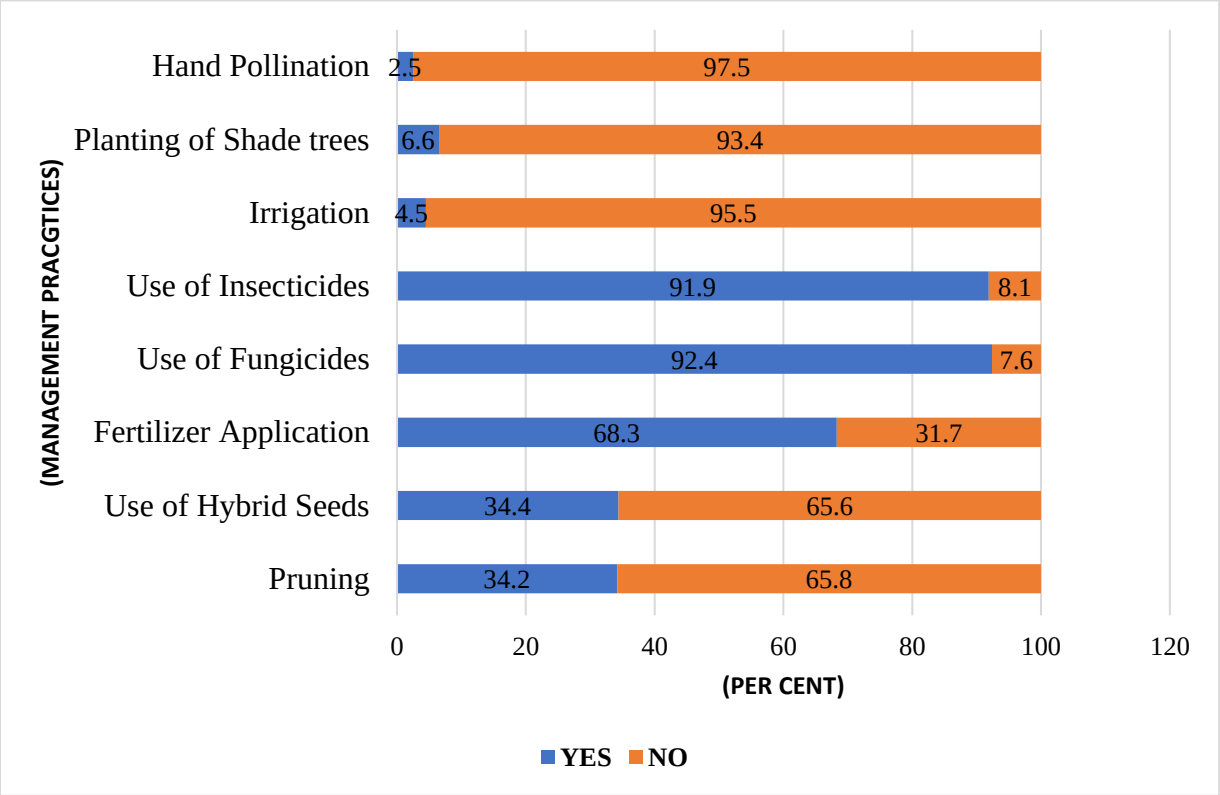
conviction that they affect cocoa yield when they are practised. It came out during the interviews; therefore, that respondents sometimes acquire loans from friends and cocoa purchasing clerks to acquire inputs such as fertilizers, fungicides and pesticides to apply on their farms and pay later.

4.6 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 4.20, farm management practices such as fertilizer application, hand pollination exercise, planting of shade trees and irrigation had a small minority of the respondents indicating that they face challenges in practising them. On the other hand, farm management practices such as application of insecticides, fungicides and fertilizer had a majority of people indicating that there are challenges that inhibit the farmers from practising 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 practising hand pollination, planting of shade trees and irrigation respectively.

However, the qualitative data revealed the specific challenges encountered by the farmers in practising the various farm management activities. These challenges can be categorised under three main factors which include lack of funds, inadequate education, and political factors.

Figure 4. 20: There are challenges in managing the farm



Source: Fieldwork, 2018

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. Another angle is that some of the farmers are old and would require hired labour to be able to undertake some of the farm management practices, but the lack of financial resource limits their ability to perform these farm management practices fully. In support of this factor, a respondent said the following:

‘‘*…the chemicals are very expensive, and money is hard to come by these days. For somebody like me who does not have any government work, I don’t have access to bank loans. So how can I buy fertilizer or kumakate to spray my farm*?’’ [42-year-old interviewee].

This affects cocoa yield and renders the farms not producing the required yield from the farms.

Inadequate education and training

A lot of the farmers recounted their limited access to extension services affecting them in the right use of certain farm management practices. Extension officers hardly visit respondents, especially those who are not part of farmer associations to benefit from some training. Due to this, some farmers do not understand the significance of certain farm management practices. This came up 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 known not 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 save some from the proceeds of cocoa to buy chemicals to supplement what the government is providing. If you want to rely on what the government provides only, you will not get anything… there is too much politics in the cocoa mass spraying. [male interviewee in Kenyasi No. 1].

4.7 Chapter Summary

This chapter presented the results of the study according to the objectives. These include the trends in cocoa production, farmers' perception of the factors that influence cocoa production, farm management practices adopted by farmers and the challenges in farm management practices.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter contains a discussion of the results of the study. The discussion is arranged according to the various sections in Chapter Five. After this introduction, the next section discusses the demographic characteristics of the respondents selected for the questionnaire survey. These include a discussion on gender, age, level of education, marital status, income and religion. Others are household size and membership in a cocoa farmer association. The next section discusses the trends in cocoa production among the respondents, after which there is a discussion on farmer perceptions on factors that affect cocoa yield. The last two sections of the chapter look at the farm management practices adopted by the farmers and how those management practices influence cocoa production; and the challenges in farm management practices encountered by the respondents. The chapter ends with a chapter summary.

5.2 Demographic characteristics of cocoa farmers in the Asutifi North District

In the conceptual framework, it has been identified that some demographic characteristics have a relationship with the perception of farmers and farmers' intention and practice of certain farm management activities. Some of these demographic characteristics include gender, age, level of education, marital status, religion, membership in FBOs, among others. This section discusses these demographic characteristics and late relates them to the outcome of the study.

Globally, there are more females than males, and that trend seems to reflect in most countries if not all. Looking at the demographic characteristics of the respondents studied, quite contrary to

the norm, there were more males than females in the study area. This is, however, not surprising considering that the district demographic data according to the 2010 population and housing census had more males (51.2%) than females (49.8%) (GSS, 2014). But the higher proportion of males compared to females can also be linked to the fact that, in most parts of Ghana including cocoa growing areas, males act as heads of households owning the farms while their wives support with farm activities. Therefore, according to the methodology which targeted cocoa farmers, it is more likely that more males will be selected compared to females.

According to Johr (2012), most data on farmers reveal ever-ageing farmer populations, especially in the rural areas. For instance, the average age of farmers in the US, Japan and in the Organisation for Economic Co-operation and Development (OECD) countries are 58, 67 and 65 years, respectively. This distribution is quite different from the study's outcome considering the fact that the average age of the respondents interviewed was 48.4 years which is far below the average age in US, Japan or the OECD countries. Considering Ghana, this figure is still below the Ghanaian average figure of 55 years (MoFA, N.D). The study's highest category of farmers is between 30 and 40, which doesn't reflect the Ghanaian situation. This could mean that more youth are considering agriculture as their main occupation in the study area. This upsurge in the youth taking to agriculture may be linked to the ban on mining that is pushing the youth to agriculture or the increase in the producer prices of cocoa.

Majority of farmers were JHS/Middle school leavers which sort of confirms the perception that farming is a prerogative of the uneducated and the poor. According to the district level statistics of the Asutifi North district majority of the residents (59.3%) have attained education up to the JHS/Middle school level which is in tandem with the study's result, although the district figure is less. The majority of these respondents who have attained education up to this level may lack the

necessary skill or knowledge to be employed in other areas thus may have farming as the most flexible option available to them.

The study has shown that there is a comparatively higher proportion of the married in the study sample compared to the district level population. In the Asutifi North district, although a minority of the residents above the age of 12 are married (46.3%), the data revealed that a far higher percentage of 73.5% of the respondents are married. The distribution is understandable because the study targeted respondents who were above the age of 20 and farmers. Farming is a difficult task, and it is assumed that only adults will engage in that activity, thus the reason for most of the farmers being married.

The proportion of poor people in the study area was marginal because the majority of the respondents had incomes above the extreme poverty line of less than $1.90 per day (World Bank, 2019). However, the proportion of respondents that can be considered as high-income earners was very low ,considering the fact that most of them earned less than GHC 1000 a month. This could indirectly affect the output from the cocoa farms as a result of farmers not being able to fund regularly, farm management practices such as fertilizer application and the spraying of fungicides and insecticides.

Originally, the religious background of residents in the Asutifi North district are Christians as shown in the 2010 population, and housing census of the district where 75.9% are Christians and 15.9% are Muslims (GSS, 2014). The only difference, however, is that in the district level statistics African Traditional religion although marginal, is represented whilst in the results of this study none of the respondents belonged to the African Traditional religion, but rather a few practised no religion. In most rural areas in Ghana, religious organizations play various roles in information dissemination through announcements in churches and peer to peer conversations. Thus, it could

be argued that initiatives carried out by the government to improve cocoa yields such as cocoa mass spraying and hand pollination exercise could reach a higher number of residents because of the wide religious affiliations in the district.

About half of the respondents do not belong to any farmer organization. This could indirectly affect cocoa output because these farmer organizations organize training sessions on best farming practices which benefit members. Also, some of these farmer organizations are able to acquire farm inputs with flexible payment arrangements. According to Penunia (2011), members of farmer organizations benefit directly from government and development agencies through programmes offered by these agencies who normally work with the farmer organizations.

Majority of farmers had more than four household members. To a farming household, this indicates the availability of extra labour to work on the farm. In cocoa farming households, household members provide supplementary support on the farm, thereby helping to increase the total output from the farm. Also, most households did not have large farm sizes. This gives credence to the fact that respondents had a low income which affects their ability to purchase more lands for cocoa farming.

5.3 Temporal analysis of cocoa production in the Asutifi North District

Ghana over the years has experienced increasing growth in cocoa production, although there has been some dip in some years. For instance, between 1995 and 2016, cocoa production in the country increased by 112%. This is as a result of many conscious efforts and interventions by governments and developing partners. For example, several mechanisms have been instituted over the years, such as cocoa mass spraying exercise, an increase in production prices, and providing

farm inputs to farmers. Looking at the data with respect to the trends in cocoa production since 2008 from the respondents, it can be observed that although cocoa production experienced steady growth, there were some years that production experienced falls. Typical examples are from 2011 to 2013 and 2016 to 2017. One factor that affects these trends is the change of government. The cocoa mass spraying exercise usually experiences a change in leadership even at the local level when there is a change in power as a result of national elections. The new leadership sometimes are selective in the spraying exercise, and this could count as one of the reasons cocoa production experienced declines in these time periods. This can be identified with the conceptual framework which links political reasons as one of the challenges which mar the adoption and practice of farm management practices. Cocoa farmers generally have low incomes thus although they perceive that spraying their farms with insecticides and fungicides will help in improving cocoa yield, they are somehow limited due to affordability issues thus rely on the government for the mass spraying exercise. For instance, the government's free fertilizer distribution is 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 (GhanaWeb, 2018).

But looking at the average output as shown by the results, it could be observed that there was heterogeneity in terms of the output in the various study communities. The communities that had higher populations or that were urban had higher outputs compared to low population areas. For instance, Kenyasi No. 2 had the highest output since 2013, and this could be attributed to the dynamics in an urban community. Urban communities have high income and are comparatively more capable in funding certain farm practices that can increase output in cocoa yield. Those in rural areas, on the other hand, may experience low incomes to fund certain farm activities.

The data showed that those who were 60 years and above had the highest cocoa output over the years. This high output associated with those in this age category can be attributed to the fact that these people might have the biggest land and may inherit most of their family's properties. It could also mean that they have had more years of accumulated resources to acquire these lands and farms. This finding contradicts a study by Amoah (2013) which found out that age is not associated with high output in cocoa farming.

5.4 Perspectives of farmers on factors that influence cocoa yield

Perceptions are important in adapting to climate change/variability with respect to cocoa farming, and therefore, a lot of people recommend the education of farmers in this regards (Ehiakpor et al., 2016). Also, improving access to weather forecast information among farmers is essential in enhancing farmer's perceptions in order for them to employ the right adaptation strategies such as changing planting dates (Ehiakpor et al., 2016). Therefore, farmer perceptions are very important in ensuring adaptation practices and subsequent increase in crop yields. The study revealed that more farmers perceived climatic factors – rainfall and temperature – having impacts on cocoa yield. This means that farmers are more likely to initiate adaptation measures to combat climate variability/change once they experience them. Farmers are able to tell the impacts of either too much, or too little rainfall/temperature on cocoa yield and all that paints a positive picture in cocoa farm management in the district.

These climatic factors, in a way, can be linked to farm management practices as they may one way, or the other serve as adaptation or mitigation measures for the climatic factors. Cocoa farms according to CSIR guidelines are supposed to be managed by farm management practices such as

weeding at least four times in a year, pruned, sprayed against insecticides, pesticides, fungicides among others as well as the application of fertilizer. Also, planting of shade trees, irrigation, and hand pollination are all management practices that ensure an increase in cocoa yield. Farmers are sensitive to some of these farm management practices but are insensitive to others. For instance, the practice of hand pollination, irrigation, and planting of shade trees are on the cocoa farm received low practice from the farmers because they perceived them to be insignificant in cocoa farming. What this means is that there is some form of limited education or extension services available to these farmers to identify the need for these farm management practices. This affects the benefits of these farm management practices as maximum crop yields that would have been obtained by these practices will not be achieved.

5.5 On-farm management practices and their influence on Cocoa yield

The perception of farmers on the effects of farm management practices on crop yield in a way is linked to the management practices engaged in by farmers. Almost the same percentage of farmers who perceived farm management practices such as fertilizer application, pruning, use of hybrid seeds, use of fungicides, and use of insecticides as having effect on cocoa yield, practised these farm management activities whiles those who perceived hand pollination, irrigation and planting of shade trees as having effect on cocoa yield was reflective of the perceptions held on the impact they have on cocoa yield. Those who do not think a particular farm management practices does not affect yield do not bother to practice it at all. This could mean that perceptions actually reflect actions in terms of cocoa farm management practices. When people hold a view about a particular farm management practices, it reflects in whether they adopt such practices or not. This is consistent with a study by Aneani et al., (2007) which concluded that, farmers preferred the

cultivation of hybrid cocoa seeds because, they perceived those seeds to be of high yielding capacity compared to local ones. The Cocoa Research Institute has identified the need for practicing the hand pollination exercise as well as irrigation in order to have an all year-round harvest of cocoa. Although this has been scientifically proven, getting farmers to harbor this knowledge has not been successful particularly in the study area. Therefore, more resources need to be spent on education as well as research so that findings can be held on to by stakeholders who matter, such as farmers.

As revealed by the study, the use of insecticides which is significant with age will require a further probe as to why this is so. Although this could be that long period of farming comes with experience and farmers who are older know the need to use insecticides and how that improves cocoa yield. Same could be talked of the level of education of farmers and how significant that is with the application of farm inputs such as fertilizer, insecticides and fungicides. Most of these benefits are thought in schools right from the basic level to a higher level, and farmers who have gone through school are more likely to understand the benefits of applying these farm inputs compared to those with less education. Although irrigation and planting of shade trees are less practiced among farmers, it was found to be significant with the level of income. This could be the preserve of farmers with comparatively higher income levels because irrigation, for instance, could be capital intensive.

The high incidence of the lack of access to extension services could reflect the poor state of engaging farmers in terms of the right methods of cocoa farming. Day in and day out, researches are carried out by bodies such as the cocoa research institute and other institutions of learning and the outcomes can positively reach farmers through some of these extension services. The results indicating poor extension services goes to reflect the nature of agriculture in Ghana and how the

business of farm is not taking much seriously by the various stakeholders in the sector. A huge chunk of the farming population does not receive extension services throughout the year, and that could affect the fortunes of the agricultural sector.

5.6 Challenges encountered by farmers in farm management practices

Cocoa farming in Ghana like any other farming method is fraught with challenges which affect overall production. Farmers adapt to these challenges by sometimes adopting certain farm management practices such as spraying, weeding, fertilizer application, among others. However, ironically, these farm management practices also come with their own difficulties. According to Awuah-Gyawu et al. (2015), poor monitoring of the distribution, coupled with corruption and politicization are major factors that affect the acquisition and use of these farm inputs. This, in one way or the other, confirms the study findings where the politicization of government initiatives such as the cocoa mass spraying exercise affect acquisition and use of farm inputs such as pesticides and fertilizer.

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, etc. applying the right measurement on the farm becomes a problem. Looking at the number of cocoa farmers in the country, the number of Agric extension officers are woefully inadequate (Awuah-Gyawu et al., 2015). This is confirmed by this study which found out that the lack of education and extension services affect the application of certain farm management practices.

Inadequate credit facilities for cocoa farmers is another big 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 the attainment of very little profit at the end of the day, which de-motivates other cocoa farmers to expand the size of their farms for lack of funds (Laven, 2010). This study further confirms the findings of Laven (2010) that the lack of funds inhibits farmers from performing certain farm management activities such as the acquisition and use of farm inputs and the ability to pay for labour employed to help in some of the farm management practices. This is a major issue in cocoa farming, and that contributes to the low productivity that comes up sometimes within the cocoa sector.

5.7 Chapter Summary

This chapter discussed the results of the study. The discussions were based on the study's objectives which include the trends in cocoa production, farmers' perception of factors that affect cocoa production, farm management practices by farmers and the challenges in farm management practices.

CHAPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 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 major findings and seeks to answer the research questions whilst the recommendations actually make suggestions for future research and policy within the cocoa sector.

6.2 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. It was 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 areas. 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 and 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. Farmers also revealed that too much sunshine leads to the destruction of the leaves and roots, which also affect crop yield. With respect to farm management practices, it was revealed that a higher majority of farmers perceived that pruning, use of hybrid seeds, 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 practised them whilst the least practised those they perceived to have no impact on crop yield. In this vein, the use of fertilizer, spraying with insecticides and fungicides, planting of hybrid seeds and pruning was frequently practised by the cocoa farmers compared to the others – hand pollination, irrigation and planting of shade trees – which were seldom practised by the farmers. The level of impact on cocoa yield perceived by the respondents was very high as a strong majority all strongly agreed to the impacts of fertilizer, insecticides, fungicides, hybrid seeds and fungicides on cocoa yield. However, with hand pollination, irrigation and shade trees, the majority of the respondents remained neutral to their benefits to cocoa yield.

The fourth and last objective was to look at the challenges of practising these farm management practices. Three main factors were highlighted as affecting cocoa farmers in their practice of the identified farm management practices. These include financial difficulties, political factors and the lack of education and training on-farm management practices. The magnitude of these challenges depends slightly on the type of farm management practice engaged in. The study revealed that

there were more challenges encountered in the use of fungicides and insecticides compared to planting cover shade trees and irrigation. These challenges are categorized into three, which are the lack of education and training, inadequate financial resources and political factors.

6.3 Conclusions

The study can conclude that there is an increasing trend in cocoa production in the Asutifi North District, although there are some dips in production in some years. These dips in production in some years may be attributed to a multiplicity of factors including political factors such as the change of government. The increase in yields 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 the anthropogenic factors include some 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 benefit on cocoa yield. Therefore, it is important to emphasize that farmers' perceptions of factors that affect cocoa yield are important in the struggle to increase cocoa yields by stakeholders.

The study also revealed that farmers engage in practices such as fertilizer application, spraying of insecticides and fungicides, pruning and the use of hybrid seeds to increase cocoa yield. They, however, do not engage in other management practices, although theoretical, they have been proven to increase cocoa yield because they do not know their benefits when it comes to cocoa

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

The study also reveals that challenges such as inadequate education and training, financial challenges as well as political factors affect the use of certain farm management practices by cocoa farmers. This makes the practice of certain farm management activities very low and affects cocoa yield by farmers. Therefore, the study concludes that there are challenges faced by cocoa farmers in practicing some farm management practices.

6.4 Recommendations

Based on the study findings, the following recommendations are 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 on the best farm management practices and also introduce new management practices to farmers. This can be done by targeting farmer associations and offering training to their members so that those training and information can be spread by them to other members or colleagues in the farming communities. This will help farmers apply the right farm inputs and methods on the farm to increase cocoa yield. Also, farmers will be introduced to the 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 on times. Also, special arrangements can be made with cocoa purchasing clerks to offer soft loans to farmers so that farmers can pay back during cocoa seasons.

- The study also recommends that policies or interventions by the government to support farmers in terms of farm inputs and other services should be given to non-partisan actors such as the COCOBOD other appointing political actors to handle. This will take away the sabotage of some farmers who are not aligned with the party in power and spread the benefits to a larger farmer population.
- The study was limited in respect to the time required in the completion of the study. This therefore based the study on farmer perceptions rather than empirical data that is testable with respect to the impacts of certain farm management 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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APPENDICES

A. Questionnaire for Cocoa Farmers

DEPARTMENT OF GEOGRAPHY AND RESOURCE DEVELOPMENT,
UNIVERSITY OF GHANA, LEGON.
(Questionnaire for cocoa farmers)

Community: ……. Questionnaire no: ……

INTRODUCTION

This questionnaire is being administered by an MPhil candidate at the Department of Geography and Resource Development as part of the requirements for the attainment of MPhil degree in Geography and Resource Development. 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 of respondents		
1.	Sex	a. Male b. Female
2.	Age	
3.	Level of education	a. No formal education b. Primary c. JHS/Middle school d. SSS/SHS/Vocational/Technical e. Tertiary f. Others (……)
4.	Marital status	a. Married b. Single c. Divorced d. Separated e. Widowed
5.	Average monthly income	
6.	Religion	a. Christian b. Muslim c. ATR d. No religion e. Other (……)
7.	Ethnicity	
8.	Are you a member of any cocoa farmer organization?	a. Yes b. No
9.	Household size	
10	What is the size of your cocoa farm?	
Section 2: Factors that affect cocoa yield		
11	Indicate your level of agreement/disagreement on the effects of the following factors on cocoa yield	

Factor	Strongly agree	Agree	Neutral	disagree	Strongly disagree
Temperature					
Rainfall					
Soil fertility					
Farm management practices					

Section 3: farm management practices

12	Which of the following farm management practices are you engaged in? (tick all that apply	
	Pruning	
	Use of hybrid seeds	
	Fertilizer application	
	Use of fungicides	
	Use of insecticides	
	Irrigation	
	Timber planting	
	Hand pollination	
13	Do you have access to extension services?	a. Yes b. No
14	If yes, how often do extension officers visit your farm?	a. Once a year b. Twice a year c. Thrice a year d. More than three times a year

15	How often do you practice the following farm management practices?	Very often	Often	NA	Not often	Not too often
	Pruning					
	Use of hybrid seeds					
	Fertilizer application					
	Use of fungicides					
	Use of insecticides					
	Irrigation					
	Timber planting					
	Hand pollination					
16	The following management practices affect cocoa yield	Strongly agree	Agree	Neutral	Disagreed	Strongly disagree
	Pruning					
	Use of hybrid seeds					
	Fertilizer application					
	Use of fungicides					
	Use of insecticides					
	Irrigation					
	Timber planting					
	Hand pollination					

17	Do you face any challenges on the application of the following farm management practices?	Yes	No	Challenge faced
	Pruning			
	Use of hybrid seeds			
	Fertilizer application			
	Use of fungicides			
	Use of insecticides			
	Land and water management			
	Timber planting			
	Hand pollination			
Section 4: Cocoa Yield				
18	On average, how many cocoa 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

B. 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.