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Assessing The Relation Between Land Ownership, Credit Accessibility, And Group Memberships On Cocoa Yield: A Case Study In The Ahafo Ano South-West District, Ghana

Master's Thesis

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Abstract

Ghana is one of the world's leading cocoa producers and the cocoa sector is a major contributor to the country's economy. The country's cocoa is considered one of the premium cocoa beans on the international market. Currently, Ghana produces 20% of the world's production and is the second largest producer and exporter of cocoa beans. The sector contributes 6-7% of GDP and employs an estimated 2 million people. It accounts for more than 30% of the agricultural sector's profits and is the most important agricultural commodity generating foreign exchange. An important percentage of government revenue comes from the export tax on cocoa. Because of cocoa's contribution to the country's economic development, various policy interventions have been made over the years to improve cocoa production, including varietal improvement, and training programmes. Despite government interventions in the cocoa industry and the crop's contribution to the country's GDP and socio-economic development, farm output per unit area is very low. Low cocoa yields remain a major problem for the sector. Some reasons have been put forward for this situation, including agronomic, geographical, socio-cultural, and economic. Farmers need credit to pay for inputs such as fertiliser, herbicides, and seedlings, and to hire labour during peak periods. However, smallholder farmers in Ghana can find it difficult to access credit, especially if they lack collateral or a credit history. Also, lower cocoa yields may result in farmers being less willing to invest in their plantations due to the lack of secure land tenure. In addition, membership of groups such as cooperatives or farmer organisations can give farmers access to information, know-how and the best farming techniques. With this information, farmers can adopt improved farming techniques and increase cocoa production. The aim of this study is therefore to examine the effect of access to credit, group membership and land ownership on cocoa yields. To this end, the study collected household level data from 416 smallholder cocoa farmers in the Ahafo Ano South-West Region of the Ashanti Region of Ghana. A purposive and random sampling technique was used to collect the data. Data were collected on the socio-economic and production characteristics of the households. The results are presented in tables with statistical interpretations made. The results showed that most farmers are old (50-59 years), have low formal education (12 years), have no access to credit, majority own the land and belong to cocoa producer associations. The analysis of variance showed

that of the three variables of interest for the study (access to credit, land ownership and group membership), only being a member of a cocoa producer association is significant in explaining variation in yield. Furthermore, the interaction between access to credit and land ownership also has a statistically significant effect on yield. The study, therefore, concluded that membership of a cocoa producer association and the interaction of access to credit and land ownership are critical in influencing cocoa yield in the study area. Based on the conclusion, the study, recommended the provision of training services to the farmers through the cocoa producer associations or groups. In addition, the government, through the Bank of Ghana, should provide fiscal incentives (reduced cooperate tax, grants) to financial institutions that provide financial services or credit to smallholder cocoa farmers. Finally, land reforms are needed to improve land tenure especially for migrant farmers to complement access to credit.

Keywords: smallholder cocoa farmer, financial services, land tenure, and cooperatives.

Declaration

I hereby declare that I have done this thesis entitled EVANS TWUM ABROKWAH independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

In Prague 21.04.2023

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Evans Twum Abrokwah

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GDP	-	Gross Domestic Product
SPD	-	Seed Production Division
QCC	-	Quality Control Company Limited
CMC	-	Cocoa Marketing Company (GH) Limited
CHED	-	Cocoa Health and Extension Division
CRIG	-	Cocoa Research Institute of Ghana
COCOBOD	-	Ghana Cocoa Board
JHS	-	Junior High School
SHS	-	Senior High School
CSSVD	-	Cocoa Swollen Shoot Virus Disease
KKFU	-	Kuapa Kokoo Farmer Union
CAA	-	Cocoa Abrabopa Association
GCCSFA	-	Ghana Cocoa, Coffee, and Sheanut Farmers Association

Chapter One

1 General Introduction and Aim of the Study

1.1 Project Background

Ghana is one of the world's leading cocoa producers and the cocoa sector is a major contributor to the country's economy. The first cocoa plants were imported to Ghana from Fernando Po by a Ghanaian farmer named Tetteh Quarshie in 1879, beginning the country's long history of cocoa production (Kuusaana & E. 2016).

Thirty years after its introduction, cocoa became the main export product of the then Gold Coast. By 1936, Ghana produced more than half of the world's supply of cocoa beans (Austin 2014). Ghana remained the world's leading cocoa producer until 1977, when it was overtaken by Brazil. Côte d'Ivoire finally overtook Brazil in 1979 (Losch 2002). Currently, Ghana produces 20% of global production and is the second largest producer and exporter of cocoa beans after the Ivory Coast (Ton et al. 2008). However, Ghana is renowned for producing the highest quality cocoa beans in the world.

For a century, the cocoa industry has been the mainstay of Ghana's economy, contributing 6-7% of GDP. Over 2 million people (or about 7% of Ghana's population) are directly or indirectly employed in the cocoa industry (Kapstein & Kim 2011). It accounts for more than 30% of the agricultural sector's profits and is the most important agricultural commodity generating foreign exchange (Clemens Breisinger et al. 2008) . About 25% of the money earned from merchandise exports comes from cocoa. An important percentage of government revenue comes from the export tax on cocoa. Roads, schools, and hospitals are just a few examples of the infrastructure that cocoa provides for socio-economic growth (Fuseini & Kemp 2015).

The Cocoa Marketing Board, now known as the former Ghana Cocoa Board (COCOBOD), was established by the government in 1947 to assist cocoa farmers with marketing. The statutory public organisation, known as the Ghana Cocoa Board, controls and monitors the operations of the cocoa sector in Ghana (Kolavalli & Vigneri 2017). The activities of COCOBOD focus on cocoa production, research, internal and external marketing, extension and quality control (Amoako 2020) .

COCOBOD's five specialised subsidiaries or divisions are structured into pre-harvest and post-harvest sectors to facilitate the activities of the organisation's headquarters and to carry out its functions successfully and efficiently. The activities of the pre-harvest sector are carried out by the Seed Production Division (SPD), the Cocoa Health and Extension Division (CHED) and the Cocoa Research Institute of Ghana (CRIG), and deal with core issues at the farm level. The Quality Control Company Limited (QCC) and the Cocoa Marketing Company (GH) Limited (CMC) are responsible for the post-harvest sector (Board 2018).

In Ghana, cocoa has historically been grown using traditional methods that have been handed down over the years. There are four different varieties of cocoa in Ghana: Criollo, Forastero (Amelonado), Trinitario and Hybrid (Fowler & Coutel 2017). Criollo and Forastero are the traditional varieties. The traditional varieties can be grown with low inputs and are known for their hardiness and disease resistance (Board 2018). Forastero and hybrid are the most common varieties used by farmers in Ghana. Traditional varieties, on the other hand, often produce lower yields and may not be as lucrative as the hybrid type (Afoakwa 2016). Hybrid cocoa varieties have become increasingly popular in Ghana in recent years. These varieties, created through genetic breeding methods, tend to produce higher yields (Fowler & Coutel 2017). They frequently require less maintenance and are more disease-resistant than conventional kinds. To get high yields, they might need more inputs, including fertilizer and insecticides, as they might be more vulnerable to other illnesses and pests. Additionally, hybrid varieties may not have the same flavor and aroma as traditional varieties, as well (Liliane et al. 2020). Regardless, the industry's future sustainability is being questioned by the fact that Ghana's cocoa yield has been dropping in recent years. This trend may be influenced by several factors, such as, group memberships, credit accessibility, and land ownership (Kehinde & Ogundeji 2022).

Land ownership is a crucial component of agriculture because it gives farmers the security and assurance they need to make improvements to their land and farming methods (Asaaga et al. 2020). However, many smallholder cocoa growers in Ghana lack official documents proving their ownership of the property, which leaves them open to eviction and land disputes. Lower cocoa yields may result from farmers being less willing to invest in their plantations due to the lack of secure land tenure (Wessel & Quist-Wessel 2022).

Another important element that influences cocoa farmers' capacity to make investments in their operations is credit accessibility. Credit is needed by farmers to pay for inputs like fertilizer, herbicides, and seedlings as well as to hire workers during busy times. However, it might be difficult for smallholder farmers in Ghana to obtain loans, especially when they lack security or a credit history (Kehinde & Ogundeji 2022).

Group memberships, such as cooperatives or farmer organization membership, can give farmers access to information, know-how, and the best agricultural techniques (Krell et al. 2021). Improved farming techniques can be used by farmers with the help of this information, increasing cocoa output. However, participation in these groups might only be open to a small number of people, especially smallholder farmers who might not have the money to pay membership dues (Effendy et al. 2019).

Few studies have looked at the relationship between land ownership, credit accessibility, and crop group memberships and cocoa yield, despite the significance of these factors for cocoa cultivation in Ghana. By examining the correlation between these variables and cocoa yield in Ghana's Ahafo Ano South-West District, this study seeks to close this gap. The results of this study will add to the body of knowledge about Ghana's cocoa industry and shed light on the variables that affect cocoa yield. In addition, the study will pinpoint the difficulties land ownership, financing availability, and group memberships present for cocoa producers and suggest recommendations to address these difficulties.

1.2 Problem Statement

Ghana's economy depends heavily on the cocoa sector, and many farmers in the nation rely on cocoa planting as a major source of income (Okoffo et al. 2016a). Despite government intervention in the cocoa industry and the crop's contribution to the GDP and socioeconomic development of the country, farm output per unit area is very low. Low cocoa yield continues to be a major problem for the sector, in part because of old cocoa fields and limited access to loans and other crucial resources (Baffoe-Asare et al. 2013).

Crop group memberships, land ownership, and credit accessibility are important factors that can have a big impact on cocoa productivity (Aidoo & Fromm 2015). The majority of the land in Ghana used for growing cocoa is owned by smallholder farmers, but they frequently lack official documentation of their land ownership, which makes it difficult for them to secure their land tenure and obtain finance. In addition, smallholder farmers have difficulty

obtaining finance due to high-interest rates and a lack of collateral (Lambrecht & Asare 2016). Crop groups can also give farmers access to information, know-how, and best agricultural techniques, enhancing cocoa yield (Akrofi-Atitianti et al. 2018).

Therefore, the purpose of this study is to determine how crop group memberships, accessibility to credit, and land ownership affect cocoa yield in Ghana. The goal of the study is to determine the difficulties cocoa farmers in Ghana encounter regarding land ownership, credit accessibility, and group memberships, as well as how these difficulties affect cocoa productivity. The results of this study will aid in the creation of efficient policies and interventions to address the difficulties faced by Ghanaian cocoa farmers, increase cocoa yields, and support environmentally friendly cocoa farming methods in Ghana.

1.3 Justification

The analysis of the effects of land ownership, the accessibility of credit, and group memberships on cocoa production in Ghana is justified by the significant economic contribution that cocoa makes to the nation, particularly by supporting livelihoods and jobs for millions of smallholder farmers. The necessity to investigate the fundamental causes affecting cocoa production has been highlighted by the recent decline in cocoa yield, which has become an important cause of concern (Board 2018).

The study is also justified since important variables that affect cocoa farming techniques in Ghana are group memberships, credit accessibility, and land ownership. Farmers' capacity to invest in their farms might be hampered by the absence of official documentation of land titles and the difficulties in obtaining loans, which eventually has an impact on cocoa yield (Board 2018). Like cooperative participation, farmer association membership can give access to agricultural information and best practices, which can result in better farming methods and higher cocoa yields (Frimpong-Manso et al. 2022).

While there is research on the Ghanaian cocoa sector, there is a lack of literature discussing how group memberships, loan availability, and land ownership relate to cocoa productivity. As a result, this study will add to the body of knowledge already available on the Ghanaian cocoa business by revealing new information about the variables that affect cocoa output and highlighting the difficulties faced by cocoa farmers in terms of land ownership, loan availability, and group memberships.

Overall, the study's conclusions will be useful to policymakers, cocoa farmers, and other industry participants because they can be used to create effective interventions to address the difficulties smallholder Ghanaian cocoa farmers face and support sustainable cocoa production.

1.4 Hypothesis

In Ghana, group membership, access to credit and land ownership all have a significant impact on cocoa productivity. Compared to smallholders who lack official land titles, those who have secured land tenure and legal proof of ownership are likely to produce more cocoa.

- **H1**: Land ownership has a statistically significant positive effect on cocoa yield.

Access to credit and other financial resources increases a farmer's likelihood of investing in better cocoa-growing techniques, which increases cocoa production (Wessel & Quist-Wessel 2022).

- **H2**: Access to credit has a statistically significant positive effect on cocoa yield.

The production of cocoa is increased when farmers who are members of crop groups have access to information, knowledge, and best practices in agriculture (Board 2018).

- **H3**: Membership of a cocoa producing group or association has a statistically significant positive effect on cocoa yield.

These hypotheses show that there are several variables and their interactions that affect cocoa production in Ghana, and that group membership, land ownership and credit availability are all significant variables that can have an impact on cocoa production. After obtaining the relevant data, the study would seek to validate these hypotheses by examining the relationship between smallholder cocoa yield, land ownership, credit accessibility and cooperative membership using statistical techniques to

1.5 Objectives of the Study

The project's goal was to analyse the effect of group memberships, credit accessibility, and land ownership on cocoa yield in Ghana's Ahafo Ano South-West District. The study's particular goals were to:

- To examine the association between cocoa farmers' land ownership and yield
- To examine how farmers' access to financing affects their ability to produce cocoa.
- To assess how group memberships affect the yield of cocoa among cocoa farmers.

- To investigate the effects of group memberships, loan availability, and land ownership interaction on cocoa yield among cocoa producers.

Chapter Two

2 Literature Review

2.1 Historical Overview of Ghana's Cocoa Industry

Mexico and several regions of tropical America are the origins of cocoa. In West Africa, particularly in the nations of Ghana, Nigeria, Cote d'Ivoire, Liberia, Sierra Leone, Togo, and Dahomey, cocoa is widely planted as a major commercial crop of the equatorial region (Losch 2002). Around 1.6 million small farmers in Ghana's Ashanti, Brong-Ahafo, Central, Eastern, Western, and Volta regions grow most of the country's cocoa on plots that are smaller than three hectares (ha) (Aneani et al. 2018). From Veracruz to Cadiz, the first cocoa shipment to Europe began in 1585 (Harwich 2020).

Ghana has a long history of cocoa cultivation that dates to the late 19th century. Tetteh Quarshie, a Ghanaian blacksmith who had been to Fernando Po (now Equatorial Guinea) and brought back cocoa beans, was the person who initially brought the crop to Ghana in 1879 (Kuusaana et al. 2021).

On the Gold Coast, which was then a British colony, cocoa was primarily farmed as a cash crop at the time. The nation's center and western regions, where the temperature and soil were suited for cocoa growing, saw the establishment of the first cocoa farms (Bjornlund et al. 2020).

In 1900, Ghana exported roughly 546.72 tons (T) of cocoa, 2,856.00 T in 1905, over 26,520.00 T in 1911, and 317,220 T in 1936, accounting for half of the world's production at the time (Amoako 2020). Ghana became the world's top cocoa producer in 1964–1965. Roughly six of the ten regions in the nation—the Volta, Central, Brong-Ahafo, Eastern, Ashanti, and Western regions—produce cocoa, which accounts for roughly fifty percent (50%) of the nation's annual production (Ameyaw et al. 2015). The light crop season, which runs from September to June, and the major crop season, which runs from October to May or June, have been designated as the two key seasons for the production of cocoa in Ghana. Planting, caring for, harvesting, drying, and bagging the beans for marketing are just a few of the tasks involved in cocoa agriculture (Adu-Acheampong et al. 2014).

According to Amoako (2020), smallholder farmers plant food crops in addition to cocoa, which is how the crop is often produced. Simple instruments like a cutlass and occasionally

hoes are used in cultivation to prepare the ground before planting seedlings. To minimize disruptions to the yield of the cocoa tree, the farmer typically chooses a location for the farm that is a little bit further out in the bush (Research Institute (IFPRI) 2017).

When the ground is being prepared for the production of food crops, the bush is cleared in the same way: by clearing the weeds while leaving a few huge trees standing, and by piling and burning the weeds (Norgrove & Hauser 2015). To provide shade for the new seedlings, larger trees are left on the field. Additionally, the farmer begins by sowing crops like cocoyam, plantain, and cassava. After that, the young seedlings are sown next to the food crops. Since young seedlings of cocoa don't need a lot of intense heat from the sun, these are done to provide a little bit of shade. The hoe and occasionally the cutlass are used for planting. Even at the fruit-bearing stage after planting, maintenance must be carried out. Depending on the variety, the cocoa tree might take anywhere from 3 to 5 years to produce fruit (Adu-Acheampong et al. 2014).

Ghana primarily cultivates four different kinds of cocoa: Criollo, Forastero (Amelonado), Trinitario, and Hybrid. Unlike the hybrid, which only needs three (3) years of gestation, the others take about five (5) years to bear fruit. To ensure a decent yield during this time, the farmer does upkeep (Kuusaana et al. 2021).

Over the years, Ghana's cocoa industry has encountered several difficulties, such as pests and diseases, fluctuating global prices, and a lack of infrastructure and farmer support services. In response, the government has implemented several laws and initiatives designed to encourage the production of cocoa and aid smallholder farmers (Wessel & Quist-Wessel 2022).

The Cocoa Swollen Shoot Virus Disease Control Program is one such initiative that was put in place in the 1950s to stop the virus's spread from wreaking havoc on the nation's cocoa fields (Gyamera et al. 2022). The Cocoa Marketing Board, officially known as the Ghana Cocoa Board, was founded by the government to control and supervise the marketing and export of cocoa in the nation(Essah & Anand 2021).

Despite the difficulties, cocoa continues to be a significant crop for Ghana's economy, supporting millions of people's livelihoods, especially in rural areas. After Côte d'Ivoire, Ghana is now the second-largest cocoa producer in the world, and the commodity is still essential to the country's economic growth (Ton et al. 2008).

2.2 Ghana Cocoa Board

The Ghana Cocoa Board (COCOBOD), also known as the Cocoa Marketing Board, is the government organization in charge of directing and controlling cocoa production, processing, and marketing in Ghana. Ghana is the second-largest producer of cocoa in the world, and cocoa exports rank among the nation's top agricultural products and make up a sizeable amount of its foreign exchange profits (Agyei et al. 2021).

To regulate cocoa production, marketing, and pricing in Ghana, the Cocoa Board was founded in 1947 (Board 2018). The Ghana Cocoa Board was later established in 1984 with the purpose of regulating and advancing the production, processing, and marketing of cocoa and its byproducts (Afoakwa 2016).

The board's primary duties include regulating cocoa prices, offering farmers technical help and training, maintaining cocoa bean quality control, and fostering the growth of the Ghanaian cocoa sector (Glin et al. 2015). Additionally, it oversees the Cocoa Stability Fund, which invests in the expansion of the cocoa sector and helps cocoa growers during times of low prices. The Ghana Cocoa Board is essential in preserving the cocoa industry in Ghana as well as the livelihoods of the country's cocoa farmers (Peprah 2015).

COCOBOD is structured into a Head Office that oversees the activities of five specialized subsidiaries or divisions divided into pre-harvest and post-harvest sectors to accomplish its goals and carry out its duties successfully and efficiently (Board 2018).

2.2.1 Pre-Harvest Sector

Any actions that take place before the cocoa pods are harvested are referred to as pre-harvest in Ghana's cocoa business. The production of high-quality cocoa beans and the long-term viability of the cocoa business depend on the pre-harvest sector activities in Ghana (Kuusaana et al. 2021). It is possible for cocoa farmers in Ghana to raise yields, lessen insect and disease-related losses, and eventually boost income and improve quality of life by successfully adopting these actions. The responsibilities of the Cocoa Research Institute of Ghana (CRIG), the Seed Production Division (SPD), and the Cocoa Health and Extension Division (CHED) fall under the Pre-harvest Sector and are focused on important concerns that affect farms (Steijn 2016).

2.2.1.1 Cocoa Research Institute of Ghana

A research institute under the Ghana Cocoa Board (COCOBOD), the Cocoa Research Institute of Ghana (CRIG) is dedicated to the study and advancement of cocoa and its associated goods. The institute's headquarters is in Tafo, in Ghana's Eastern Region, and it was founded in 1938 (Board 2018).

The Ghanaian Cocoa Research Institute conducts agronomic studies on issues pertaining to the sustainable development of cocoa and other COCOBOD mandated crops (Shea, Cashew, Coffee and Kola). Further to producing premium planting materials for SPD, it also offers guidance and information on issues pertaining to the cultivation of commodities like cocoa and others that must be grown in accordance with regulations (Board 2018). To effectively disseminate research findings, new discoveries, cutting-edge technologies, and agronomic techniques to farmers, it also builds strong links with extension.

The growth and sustainability of Ghana's cocoa sector are greatly influenced by CRIG. Its research and development efforts improve cocoa quality and yields, boost processing effectiveness, and add value to cocoa products, all of which support the livelihoods of cocoa farmers as well as the Ghana's economy (Deans et al. 2018).

2.2.1.2 Seed Production Division

Producing and distributing high-quality cocoa seeds to farmers is the responsibility of the Ghana Cocoa Board's (COCOBOD) Seed Production Division (SPD). The division includes regional offices spread out across the nation's cocoa-growing regions, with its headquarters located in Tafo in Ghana's Eastern Region (Board 2018).

The Seed Production Division oversees efficiently and economically multiplying and distributing improved cocoa and coffee planting materials to farmers (Aneani et al. 2018).

In Ghana, the SPD is essential to the development of high-quality cocoa. The division helps to improve cocoa yields and quality by making sure that only top-notch seeds are sent to farmers. This improves the life of cocoa farmers and the country of Ghana's economy (Board 2018).

2.2.1.3 The Cocoa Health and Extension Division (CHED)

A division of the Ghana Cocoa Board (COCOBOD), which oversees regulating cocoa production and marketing in Ghana, is the Cocoa Health and Extension Division (CHED). Through research, extension, and farmer assistance initiatives, the CHED was founded in

2002 with the goal of enhancing the productivity and sustainability of Ghana's cocoa sector (Board 2018).

In Ghana, CHED oversees extension services, rehabilitating outdated and unproductive cocoa fields, and controlling the Cocoa Swollen Shoot Virus Disease. The Division oversees managing and overseeing the new Cocoa Extension System, which functions within the framework of a Public Private Partnership (Board 2018). By helping cocoa farmers gain knowledge and skills in sustainable agricultural methods, it offers an efficient and affordable extension to them. To help them view farming as a business endeavor that increases farmers' productivity, farmers are also schooled in fundamental economics (Wuepper & Sauer 2016). The Cocoa Health and Extension Division (CHED) is essential in supporting the viability and competitiveness of Ghana's cocoa sector, which is a major contributor of the nation's economic growth (Manteaw et al. 2018).

2.2.2 Post-Harvest Sector

Anything that happens after the cocoa pods have been harvested is referred to as the post-harvest sector of the cocoa business in Ghana. The production of high-quality cocoa beans and the long-term viability of the cocoa business depend on the post-harvest sector activities in Ghana(Afoakwa 2016). It is possible for cocoa processors in Ghana to help keep Ghanaian cocoa's reputation as some of the best in the world by ensuring that only premium beans are utilized in the creation of chocolate and other cocoa-based goods. The Quality Control Company Limited (QCC) and the Cocoa Marketing Company (GH) Limited (CMC) perform the post-harvest sector's duties (Badrie et al. 2014).

2.2.2.1 Quality Control Company

The Quality Control Company (QCC) oversees inspecting, grading, and sealing cocoa, coffee, and sheanuts for both domestic and foreign markets. It is also in charge of disinfesting goods. The QCC, a division of the Ghana Cocoa Board (COCOBOD), oversees making sure that the cocoa, coffee, and sheanut quality adheres to international standards (Kuusaana et al. 2021).

For Ghana to continue to be known as a top producer of high-quality agricultural products, the Quality Control Company is crucial in ensuring the quality of the cocoa, coffee, and sheanuts produced in Ghana (Roldan et al. 2013).

2.2.2.2 Cocoa Marketing Company of Ghana (CMC)

A subsidiary of the Ghana Cocoa Board, the Cocoa Marketing Corporation (CMC) of Ghana oversees selling and exporting Ghanaian cocoa beans. Aiming to increase the effectiveness of Ghana's cocoa marketing system and guarantee that cocoa farmers receive fair prices for their products, the company was founded in 1993 (Board 2018).

The CMC handles both the board's takeover and external marketing duties within the internal marketing system (van Huellen & Abubakar 2021).

CMC collaborates closely with cocoa farmers and cooperatives to buy their beans at fair prices and guarantee that quality control procedures are followed. The company additionally offers logistical assistance for moving cocoa beans from remote areas to the port for export (Glin et al. 2015).

Along with performing marketing duties, CMC also conducts research and development to raise the quality and quantity of cocoa beans made in Ghana. To enhance growing practices and boost output, the firm also offers training and support services to cocoa farmers (Ahoa et al. 2020).

Ghana is one of the world's top cocoa bean producers, and the cocoa sector significantly contributes to the nation's economy (Musah et al. 2019). By assisting farmers and encouraging the export of premium cocoa beans, the Cocoa Marketing Corporation of Ghana plays a critical part in safeguarding the long-term viability of the cocoa sector (Amankwah-Amoah et al. 2018).

2.3 Challenges and Threats to Sustainable Cocoa Production

The yield per unit area on farms is generally low, despite government initiatives in the industry and the crop's contribution to the national GDP and socioeconomic growth. This poor output is caused by a variety of issues, including tree stock, farm management, the environment, and extension service delivery (Board 2018).

2.3.1 Tree Stock

2.3.1.1 Old Age of Cocoa Trees (The Majority of Cocoa Farms are Over 30 Years Old)

In Ghana, most cocoa fields are older than 30 years old, and many are considerably older. This is because it takes cocoa trees several years to grow and begin yielding a sizable number of cocoa pods (Fowler & Coutel 2017). With the right upkeep and care, they can keep producing cocoa for several decades after that. Older cocoa farms, however, come with

significant difficulties. It's possible for the soil to run out of nutrients over time, which would make it more difficult for the plants to produce high-quality cocoa. Moreover, diseases and pests are more likely to affect older trees, which can lower quality and yields (Asigbaase et al. 2019).

2.3.1.2 Low Yielding Traditional Varieties Are Most Common (Limited Use of Hybrids)

The traditional, low-yielding cocoa varieties predominate in Ghana's cocoa industry. Because of their distinctive flavor characteristics and tolerance to local pests and diseases, these types have been farmed in Ghana for decades (Awudzi et al. 2016).

Nonetheless, there has been a push recently to bring new hybrid varieties with higher yields to Ghana's cocoa farms. These hybrids, which combine traditional cocoa varieties with high-yielding varieties from different areas, have the potential to provide much higher cocoa yields (Amponsah-Doku et al. 2022).

Hybrid varieties have not been widely adopted in Ghana despite this attempt. There are several causes for this (Aneani F & Ofori-Frimpong K 2013). First, due to their unfamiliarity and potential lack of confidence in their ability to produce high-quality cocoa, many farmers are hesitant to transition to hybrid varieties. Second, there are certain practical issues with introducing new varieties, such as the requirement for new seedlings and instruction in proper maintenance and care (Jong & Harts-Broekhuis 2018).

2.3.1.3 Small Farm Sizes Due to The Fragmentation of Land Tenure Systems

The fragmentation of land tenure systems, which results in small farm sizes, is in fact a severe concern for Ghana's cocoa industry (Aggrey et al. 2021). Many times, several people or families will share ownership of one or more tiny pieces of land that were once part of a cocoa farm. As a result, there has been significant fragmentation, with many cocoa fields being only a few acres in size (Aidoo & Fromm 2015).

Farmers may find it challenging to invest in cutting-edge farming methods and machinery due to this fragmentation and to obtain economies of scale (Asiama et al. 2017). Although each individual landowner may have different ideas about how to manage their piece of the farm, it can also make it more difficult to put best practices for sustainable farming into effect (Aggrey et al. 2021).

2.3.2 Farm Management

2.3.2.1 Poor Farming Practices (Disregard for Proper Agriculture Techniques)

Inadequate management of cocoa farms presents a serious obstacle for Ghana's cocoa business. Poor agricultural methods are used by a large portion of the country's cocoa farmers, which can result in decreased yields, decreased quality, and increased vulnerability to pests and diseases (Wessel & Quist-Wessel 2022).

The employment of old farming practices, such as the slash-and-burn approach, which can harm the soil and decrease its fertility over time, is one of the most prevalent instances of poor cocoa field management practices in Ghana. Moreover, farmers might overuse fertilizers and pesticides, which could be bad for the environment, decrease soil fertility, and promote pest resistance (Baweja et al. 2020).

Also, a lot of Ghanaian cocoa producers lack the necessary support and training to use the best cultivation methods. This may result in a lack of understanding of effective pruning methods, disease control, and other crucial cocoa farming concepts (Onumah et al. 2014).

2.3.2.2 The Inefficient and Limited Use of Agricultural Inputs as Fertilizers, Fungicides, Herbicides, and Insecticides

The limited and irrational use of agricultural inputs, such as fertilizers, fungicides, herbicides, and insecticides, is a key obstacle for Ghana's cocoa sector. Many cocoa farmers in the nation either don't use these inputs at all or use them in an irregular or erratic way, which can result in poorer yields, lower quality, and higher vulnerability to pests and diseases (Adu-Acheampong et al. 2014).

The cost of these inputs, which can be excessively expensive for many smallholder farmers, is one reason why agro inputs are only used in small quantities in Ghana's cocoa industry (Diarra & Tasie 2017). Some farmers could also be unwilling to use these inputs because they are worried about how they would affect the environment or their own health (Bouttes et al. 2019).

Lack of access to correct and trustworthy information about how to use agricultural inputs properly is another problem. Other farmers might not have access to training or educational resources that could aid in their understanding of the proper and safe use of these inputs (Leavy & Hossain 2014).

2.3.2.3 Some Farmers Use Unauthorized Agrochemicals in The Production of Cocoa

A major issue for Ghana's cocoa business is some farmers' use of prohibited agrochemicals in the production of cocoa (Okoffo et al. 2016b). Some farmers use these pesticides improperly or without understanding the risks involved, which has an adverse effect on the environment, human health, and the quality of the cocoa that is produced (Okoffo et al. 2016). The limited supply of approved chemicals in some places is one factor contributing to the usage of unapproved agrochemicals. Due to the ease of obtaining or lower cost of prohibited chemicals compared to allowed ones, farmers may utilize them. Also, some farmers might not have access to information about how to use these chemicals properly or they can be mistaken about their safety and effectiveness (Adu-Acheampong et al. 2014).

2.3.2.4 The Difficulty of Managing Excessively Tall (10 – 15 M) Cocoa Trees

It can be challenging for farmers to efficiently manage their fields if cocoa trees are overly tall, reaching heights of up to 10 - 15 meters. Tall trees make managing cocoa fields more labor-intensive since workers must climb the trees to access the cocoa pods for harvesting and other maintenance tasks like pruning and insect management (Nair 2021).

Moreover, tall cocoa trees may result in problems like decreased yields and an increased vulnerability to pests and diseases. Trees that are too tall might get less sunlight and nutrients, which would result in fewer flowers and pods. Tall trees may also be harder to treat with fertilizer and insecticides, which increases the likelihood of disease and pest infestations (Vaast & Somarriba 2014).

2.3.3 The Environment

2.3.3.1 Erratic Rainfall and Increasing Temperatures as a Result of Climate Change

Climate change has the potential to make these problems worse in the coming years, which would provide serious difficulties for Ghanaian cocoa growers. These factors may affect the productivity and quality of cocoa as well as raise the danger of pests and diseases (Asante & Amuakwa-Mensah 2014).

Erratic rainfall might result in crop failure or lower yields since cocoa trees need a steady supply of water all year round (Fagariba et al. 2018). In addition to degrading soil and raising the possibility of erosion, droughts can also lower agricultural output. On the other side, floods brought on by excessive rain can harm cocoa trees and cause soil erosion (Asante & Amuakwa-Mensah 2014).

In addition to affecting tree growth and the probability of pest and disease infestations, rising temperatures can also have an impact on cocoa production. By changing the chemical composition of the beans at high temperatures, cocoa quality can also be reduced (Suh & Molua 2022).

2.3.3.2 The Growth of Non-Cocoa Crops (Example, Rubber Plantations) and the Competition for Land and Labor from Unauthorized Surface Mining (Galamsey)

For cocoa producers in Ghana, competition for land and labor from unregulated surface mining activities (Galamsey) and the growth of non-cocoa crops like rubber plantations can pose serious difficulties (Board 2018).

Galamsey, or unregulated surface mining, is a practice that frequently uses heavy machinery that can harm cocoa trees and contaminate soil and water sources. As a result, soil erosion and pollution are potentially increased, and cocoa fields' output may suffer (Mantey et al. 2020).

However, the development of non-cocoa crops like rubber plantations may put cocoa growers in direct competition for resources like land and labor. As a result, the number of cocoa farms may decrease, less suitable land may be available for its production, and the industry's overall productivity may be affected (Mensah et al. 2015).

2.3.3.3 Expansion of Cocoa Plantations Through Forest Degradation

The viability of the cocoa industry in Ghana is seriously threatened by the growth of cocoa fields through the clearing of forests. Not only does deforestation contribute to the extinction of biodiversity, but it also causes soil erosion and alters regional weather patterns (Takyi et al. 2019).

For the growth and productivity of cocoa trees, forests are crucial in regulating the climate and safeguarding water sources (Wessel & Quist-Wessel 2022). In addition to threatening the livelihoods of local communities that depend on the forest for their well-being, clearing forests for cocoa expansion can result in the loss of these essential ecological services (Amponsah-Doku et al. 2022).

2.3.3.4 Producing Cocoa with Little or No Shade Leads to Unsustainable Yield (Production Declines with Time)

Production of cocoa in areas with little or no shade can lead to unsustainable yields and a gradual loss in productivity (Aidoo & Fromm 2015). The growth and productivity of cocoa

trees depend on the favorable microclimate conditions provided by shade plants like plantains, bananas, and wood species. These circumstances include controlling soil temperature, retaining soil moisture, and cycling nutrients (Amponsah-Doku et al. 2022).

Without trees to provide shade, cocoa trees are exposed to direct sunshine, which can cause heat stress, water stress, and nutritional depletion (van Vliet & Giller 2017). This may lead to lower cocoa yields, heightened vulnerability to pests and diseases, and a shorter lifespan of cocoa trees that can produce (Yamoah et al. 2021). Moreover, the lack of shade trees may result in soil erosion, nutrient depletion, and biodiversity loss (Bayle 2019).

2.3.4 Extension Service Delivery

2.3.4.1 Low Ratio of Extension Agents to Farmers

The low ratio of Extension Agents to Farmers is a problem for Ghana's cocoa sector. Extension agents are essential in informing cocoa farmers about proper agricultural practices, managing pests and diseases, and other facets of cocoa production (Obeng Adomaa et al. 2022). They also provide training and technical support to farmers. Yet, there aren't enough Extension Agents in Ghana to help all the country's cocoa farmers adequately (Bosompem 2021).

The sustainability of the cocoa industry in Ghana is affected in numerous ways by the low ratio of extension agents to farmers (Adu-Acheampong et al. 2014). Low yields and poor-quality cocoa may result from farmers' lack of access to current information on good agricultural methods (Bosompem 2021). Also, this might lead to the spread of pests and diseases, which would lower cocoa yields and quality even more (Ali et al. 2018).

2.3.4.2 Inadequately Resourced Extension Personnel

The cocoa business in Ghana faces a dilemma with under-resourced Extension staff. To help cocoa farmers with proper agricultural techniques, managing pests and diseases, and other facets of cocoa production, extension workers are essential (Naab et al. 2019). To do their jobs well, Extension personnel frequently lacks the tools they need, including transportation, communication technology, and training (Antwi-Agyei & Stringer 2021).

The sustainability of Ghana's cocoa industry is affected by this issue in several ways. Low yields and poor-quality cocoa might result from farmers not getting timely and accurate information on proper agricultural techniques (Aidoo & Fromm 2015). Moreover, the quality

and production of cocoa may be further decreased if Extension personnel are unable to efficiently monitor and manage the spread of diseases and pests (Tothmihaly et al. 2019).

2.3.4.3 Low Technological Uptake by Farmers

The Ghanaian cocoa sector is facing a challenge due to the low adoption of technology by farmers. Many cocoa farmers in Ghana continue to use old, inefficient methods of cocoa production despite major developments in agricultural technologies, such as improved seed varieties, fertilizers, and insect management strategies (Otchere et al. 2013).

The sustainability of Ghana's cocoa industry is affected by this issue in several ways. Lack of adoption of new technologies by farmers may result in poorer yields and lower-quality cocoa production, which can have an impact on their income and way of life (D. Ricketts et al. 2014). The implementation of new technologies can also increase the cocoa growers' resistance to climate change and other difficulties (Amankwah-Amoah et al. 2018).

2.3.4.4 Inappropriate Extension Packages

The Ghanaian cocoa business is struggling with inappropriate extension packages. Extension personnel offer cocoa farmers several technical recommendations and assistance to help them improve their farming methods, control of pests and diseases, and other elements of cocoa production (Wessel & Quist-Wessel 2022). However, some of these packages might not be appropriate for the extraordinary situations and requirements of Ghanaian cocoa growers (Danso-Abbeam & Baiyegunhi 2017).

The sustainability of Ghana's cocoa industry is affected by this issue in several ways. Inappropriate guidance or assistance from extension agents to farmers may result in reduced yields, subpar cocoa, and other unfavourable effects (Kempf 2016). Inappropriate extension programs can also damage farmer and Extension worker trust, which can further reduce the efficiency of Extension services (Thomas et al. 2022).

2.3.4.5 Varying Extension Messages by Partners

The cocoa business in Ghana faces a hurdle due to the different extension signals sent by partners. Extension services for cocoa growers are provided by a variety of partners, including government agencies, NGOs, research institutes, and corporate sector organizations (Ingram et al. 2018). Yet, it's possible that various parties have diverse perspectives and messages on cocoa production, which could confuse farmers and reduce the value of Extension services (Ingram et al. 2018).

The sustainability of Ghana's cocoa industry is affected by this issue in several ways. Lower yields, poorer-quality cocoa, and other negative effects may result if farmers receive conflicting or inconsistent advice from several Extension providers. It can also damage the relationship of trust between farmers and Extension specialists, which could reduce the efficiency of those services (Asare-Nuamah et al. 2019).

2.3.5 Others

2.3.5.1 Old Age of Farmers

Farmers in Ghana's cocoa business are getting older, which is a problem. In Ghana, there are a lot of aged cocoa farmers, and the next generation isn't usually interested in carrying on the family business. This pattern is alarming since it might eventually result in a shortage of knowledgeable farmers and a drop in cocoa production (Rioux 2013).

The sustainability of Ghana's cocoa industry is affected by this issue in several ways. Lower yields, poorer-quality cocoa, and other negative effects may result from a lack of qualified farmers managing cocoa fields. Furthermore, it can result in a reduction in the social and economic well-being of rural areas that depend on cocoa farming (Migheli 2021).

2.3.5.2 Limited Access to Credit

The Ghanaian cocoa sector has difficulties due to limited finance availability. Lack of finance for many Ghanaian cocoa farmers might make it difficult for them to make investments in their operations, buy inputs, and adopt cutting-edge technologies (Amankwah-Amoah 2015). The sustainability of Ghana's cocoa industry is affected in multiple different ways by this problem. Farmers who are unable to obtain credit may be compelled to turn to criminal lenders that charge exorbitant interest rates, which can result in debt and unstable finances (Astrid Fenger et al. 2016). Without loans, farmers could also be unable to make the necessary investments to increase their productivity and profitability, which could result in lower yields and cocoa of lower quality (Wessel & Quist-Wessel 2022).

2.3.5.3 Poor Access to and Unavailability of Inputs

A problem for the Ghanaian cocoa business is the lack of and poor access to inputs. The inability of many cocoa farmers in Ghana to get high-quality inputs like fertilizers, herbicides, and improved planting materials can limit their capacity to increase productivity and produce cocoa of the highest quality (Wessel & Quist-Wessel 2022).

The sustainability of Ghana's cocoa industry is affected by this issue in several ways. Farmers might not be able to control pests and diseases, increase soil fertility, or use new varieties and planting materials that are more productive and disease-resistant without access to high-quality inputs. This may result in decreased yields, poor-quality cocoa, and lower farmer earnings (Kozicka et al. 2018).

2.3.5.4 Labour Shortage

Ghana's cocoa industry is struggling with a labour deficit. In Ghana, many cocoa farms are run and controlled by families who hire their relatives as workers (Luckstead et al. 2019). The youth are, however, rapidly leaving rural areas in quest of better economic prospects, which is creating a labour deficit in the agricultural industry (Hill & Vigneri 2014).

The sustainability of Ghana's cocoa industry is affected by this issue in several ways. Farmers could not be able to do necessary tasks like planting, weeding, and harvesting without enough labour, which could result in lower yields and inferior-quality cocoa. Also, the lack of labour may force farmers to pay higher labour costs, which may hurt their profitability and make it harder for them to compete with other crops or industries(Fowler & Coutel 2017).

2.3.5.5 The Smuggling of Cocoa Beans and Other Supplies into Neighbouring Nations

The Ghanaian cocoa business faces difficulties due to the smuggling of cocoa beans and other supplies into bordering countries. This is a result of the pricing differences between Ghana and its neighbors, which encourage farmers to sell their goods across national borders (Amankwah-Amoah et al. 2018). In addition, there are occasions where subsidies for inputs like fertilizers, insecticides, and herbicides in Ghana are smuggled to nearby nations so they can be sold there for more money (Benin et al. 2013).

The sustainability of the cocoa business in Ghana may be affected in a number of ways by the smuggling of cocoa beans and inputs (Amankwah-Amoah et al. 2018). Firstly, it may result in reduced pricing for farmers because of an oversupply of cocoa beans in nearby nations. This could lower the income of cocoa farmers and make it more challenging for them to make improvements to their plantations or use new technology (Musah et al. 2019).

Secondly, because the inputs intended to sustain the cocoa sector are being diverted to other markets, input smuggling may result in shortages in Ghana. This could result in lower yields and even worse cocoa, which would make it harder for Ghanaian cocoa to compete on global markets (Amankwah-Amoah et al. 2018).

2.3.6 Interventions

The sustainability of cocoa production is threatened by several obstacles. COCOBOD and its Subsidiaries/Divisions have implemented several interventions in response to these difficulties facing the cocoa sector. These are a few of these interventions:

2.3.6.1 Seedlings Production

One of the top countries worldwide for cocoa production is Ghana. It is essential to have a consistent supply of high-quality cocoa seedlings for planting if the cocoa business is to be sustained (de Boer et al. 2019). To promote the planting of superior planting materials and maintain the sustainability of cocoa production, hybrid seedlings are raised and dispersed. Seed Production Division (SPD) and Cocoa Health and Extension Division (CHED) work together to produce and distribute seedlings (Afoakwa 2016).

2.3.6.2 Cocoa HiTECH

The Cocoa HiTECH initiative was launched in 2003 to educate farmers on the value of applying fertilizer to increase cocoa production. The term "cocoa hi-tech" describes the application of modern technology and innovation to enhance cocoa farming procedures, boost output, and support sustainability in the cocoa sector (Baffoe-Asare et al. 2013).

2.3.6.3 Cocoa Rehabilitation

Around 40% of Ghana's cocoa tree stock is thought to be unproductive. These includes farms that are too old and have the Cocoa Swollen Shoot Virus Disease (CSSVD) infection (Ameyaw et al. 2014).

To address the issue, COCOBOD advises farmers to take out and replace hybrid cocoa seedlings on infected farms with CSSVD, maintain productive cocoa fields by regular farm maintenance, the removal of mistletoe, and fertilizer application (Ameyaw et al. 2015).

2.3.6.4 Extension Service Delivery

Many improvements have been made to the Cocoa extension. The current extension delivery and cost-sharing structure operates under the framework of public-private partnerships (Steijn 2016). The idea is to work with a small team of motivated employees who have received professional training and are highly equipped to offer business-minded farmers cost-effective and efficient cocoa extension services (Opoku 2016).

With demonstrations, gatherings, farm visits, house visits, radio programs, and group meetings, farmers are educated on good agricultural practices. Under the Farmer Business

School (FBS) model, which was jointly created with German Development Cooperation (GIZ), farmers are also taught to see cocoa production as a business (Board 2018).

2.3.6.5 Youth In Cocoa

The average age of cocoa farmers in Ghana is thought to be around 55 years old. COCOBOD is promoting the creation of youth organizations to improve and facilitate their access to farmland, extension education, inputs, and credit to sustain the cocoa industry (Onumah et al. 2014).

2.3.6.6 Farmer Awards

At the District, Regional, and National Levels, COCOBOD recognizes deserving cocoa, shea, and coffee farmers during the annual National Farmer's Day celebrations. The selection of farmers is based on their output, contributions to their communities, and use of good agronomic practices (Owusu et al. 2020).

2.4 Land Ownership and Cocoa Yield

Ghana's cocoa industry depends heavily on land, and there are many different land tenure and holding arrangements that vary by location and ethnic group. Ghanaian customs and traditions are used to determine how to acquire, use, and dispose of land (Paaga 2013). Through both passed legislation and accepted customs, the Ministry of Land and Forests controls land administration. The Allodial interest, Common Law Freehold, Leasehold including subleases, Customary Tenancies, and Customary Freehold are the five main types of land rights recognized in Ghana (Abubakari et al. 2016).

The greatest proprietary interest recognized by customary law is known as an allodial interest, which is held by stools, skins, tendana, sub-stools, clans, or families who serve as the land's stewards (Mabe et al. 2019). With the approval of the major members, the group's leader manages the land in the community's best interests. Allodial title is only available to indigenous people, and it can be given or purchase (Akrofi 2014).

Members of a landowning group who earn their interest by first cultivation or allotment are said to own customary freehold (Kuusaana & Eledi 2015). They can utilize and occupy any area of the land that is owned collectively and has not yet been inhabited by a member of the community thanks to this interest (Obour et al. 2015). The freeholder may freely transfer and dispose of it to community members but transfers to outsiders require the approval of the relevant head and major elders of the landowning community. If it is kept and used by

community members, the customary freehold prevails over allodial title holders and is perpetual (Kuusaana & E. 2016).

An interest in land known as a common law freehold results from a grant of a freehold made by the owner of an allodial title through a sale or gift (Kugbega & Aboagye 2021). This interest, which derives from common law principles, is held indefinitely. Prior to the abolishment of their rights in 1969, non-Ghanaians may purchase a common law freehold, but they are now only permitted to hold a lease for a maximum of 50 years (Asiama & Arko-Adjei 2022).

Leaseholds are issued for a set period and are subject to specified conditions and rent. Owners of an allodial title, a customary freehold, or a common law freehold may award leaseholds for land as long as they haven't done so already. Often utilized by settlers, leasehold agreements have a maximum duration of 99 years for Ghanaians and 50 years for foreigners (Johnson Gaither et al. 2019).

In the cocoa industry, sharecropping is widespread and can be divided into two types: abunu (50:50) and abusa (one-third to the tenant and two-thirds to the landowner) (Tease et al. 2023). Within a predetermined timeframe, the sharecropper grows the entire farm, after which the landlord divides the mature farm in half. Following the sharing, the land and trees belong to the sharecropper and can be passed down to succeeding generations (Baah & Kidido 2020).

According to recent reports, if cocoa trees are killed or cut down, including on purpose for farm rehabilitation, the land reverts to the proprietor, which has significant ramifications for managing CSSVD and restoring farms (Kyere 2018). Replanting with certified hybrid planting material is advised in place of removing unhealthy trees, according to current recommendations. Sharecroppers might be hesitant to restore farms and run the risk of losing their land, though, because some landowners might not agree with or comprehend (Aneani et al. 2018).

A landowner establishes a farm under the abusa sharecropping model, and a sharecropper, or caretaker, farms and maintains the entire farm. One-third of the crop revenues go to the caretaker, while two-thirds go to the landowner (Baah & Kidido 2020). The caretaker is not given ownership rights to the land or farm, and the landowner is free to end their arrangement at any time. Due to rising land pressure from competing land uses and fragmentation,

sharecropping systems are shifting. Indigenous people have the option of farming more land than what has been allotted to them by the government by means of sharecropping (Amanor et al. 2020).

Land security is essential for rural households and is associated with increased investment, productivity, and living standards. A stable land tenure is a requirement for sustainable development, improved natural resource management, and agricultural intensification (Holden & Otsuka 2014). Low investments and a shift in household income and labor to less productive endeavours are caused by a lack of security of tenure. Farmers who own their land or have long-term usage rights are more likely to invest in it. In comparison to Ghanaian farmers, Kenyan farmers report better levels of land tenure security and a greater desire to invest in their holdings (Ecker 2018).

Farmers' sense of duty and planning horizon are impacted by the stability of their land tenure, which influences their decision to implement conservation measures (Holden & Otsuka 2014). Farmers may be reluctant to invest in soil conservation strategies if their land tenure is uncertain because they worry that they may not reap the rewards (Nguyen et al. 2016).

2.5 Credit Accessibility and Cocoa Yield

Much research on technology adoption and credit availability have been conducted. In 2010, the Ministry of Food and Agriculture reported that due to poverty and restricted access to financing, most Ghana's small-scale farmers are unable to afford basic production methods like fertilizer and other agrochemicals, which results in low crop yields (Yaro 2013).

For cocoa farmers, having access to credit is essential since it can considerably boost their capacity to purchase agricultural inputs and assist remove capital limitations on cocoa output by funding the purchase of production inputs (Astrid Fenger et al. 2016). As a result, the opportunity costs of capital-intensive assets in comparison to family labor are lower, promoting the adoption of high-yielding technology (Obuobisa-Darko 2015).

Credit restrictions have a negative impact on farm output, profit, and investment in emerging nations' rural areas (Anaglo et al. 2014). Low agricultural production in Ghana is largely caused by a lack of financing, and funding is necessary for farmers to develop their businesses or embrace new technology. Access to loans for smallholder farmers is restricted by factors including credit constraints (Kusi et al. 2015).

Despite attempts by the government and NGOs to promote cocoa production, its adoption remains low due to credit restrictions and the high cost of inputs. Farmers can use credit to mobilize savings and encourage investments to bring about sustained economic growth (Obuobisa-Darko 2015).

The bulk of cocoa producers are small-scale farmers who cannot afford the expensive inputs needed for modern cocoa production methods due to their limited financial means (Hilson & Garforth 2013). The implementation of cutting-edge cocoa technologies has been severely hampered by the high cost of inputs, a lack of agricultural credit, high interest rates, and both (Obuobisa-Darko 2015).

2.6 Group Membership and Cocoa Yield

In addition to the Ghana Cocoa, Coffee, and Sheanut Farmers Association (GCCSFA), there are two more significant farmer organizations: the Kuapa Kokoo Farmer Union (KKFU), which has over 50,000 members, and the Cocoa Abrabopa Association (CAA), which has over 18,000 members (Laven & Boomsma 2012). The Agro Eco-Louis Bolk Institute oversees smaller, organic cocoa organizations. Farmers occasionally collaborate in labor exchange groups (nnoboa), and some have participated in farmer field schools (Glin et al. 2015).

Without farmer groups, there can be no sustainable cocoa production. It is very expensive to provide services to individual farmers. Moreover, certification requirements include being organized. This is a significant challenge because the majority of cocoa producers are not organized (Ansah et al. 2019).

Many cocoa organizations offer their members technical support and training programs. This includes the most effective methods for managing pests and diseases, post-harvest processing, and other pertinent abilities (Villacis et al. 2022). The adoption of more cutting-edge and environmentally friendly cocoa farming techniques and the improvement of cocoa farmers' farming methods can all lead to an increase in cocoa yield (Afoakwa 2016).

For their members, cocoa groups can make it easier for them to get high-quality seeds, fertilizer, insecticides, and other inputs. To keep cocoa trees healthy and increase cocoa yield, these inputs are essential (Wessel & Quist-Wessel 2022). Organizations that support the cocoa industry can also assist farmers in gaining access to capital, infrastructure, and tools for improving their cocoa plantations, which may enhance cocoa yield (Avane et al. 2022).

Farmers may be able to market their cocoa beans together and bargain for higher prices for their goods thanks to cocoa groups (Fowler & Coutel 2017). By combining their financial resources and negotiating power, cocoa producers may increase the price they receive for their beans, increasing their income and encouraging investment in their cocoa farms. As a result, there may be more incentive and funding available to enhance cocoa growing techniques, increasing cocoa productivity (Roldan et al. 2013).

Organizations that support the production of cocoa frequently help their members achieve certifications like Fairtrade, Organic, or Rainforest Alliance, which can provide them access to premium markets where the price of sustainably produced chocolate is greater. Increased prices for certified cocoa may encourage growers to use eco-friendly farming techniques, increasing cocoa yield (Glin et al. 2015).

Cocoa organizations can help their members network and share information. This enables farmers to share knowledge, exchange ideas, and stay current on the most recent methods for growing cocoa, as well as market and industry trends (Djokoto et al. 2016). Members of a group of cocoa farmers have access to important data and expertise that can help them increase their cocoa harvest (Awudzi et al. 2016).

Chapter Three

3 Materials And Methods

3.1 Study Area

The research was be conducted at Ahafo Ano South-West District. The Ahafo Ano South-West District is one of Ghana's 261 Metropolitan, Municipal and District Assemblies (MMDAs) and is one of the 43 MMDAs in the Ashanti Region. The Ahafo Ano South-West District is situated in the northwest of the Region, between latitude 6° 49' north and longitude 1° 52' west, with Mankranso as its capital (Atampugre et al. 2022). The district was established by Legislative Instrument (LI) 2323, which encompasses a total surface area of approximately 1190.7 km^2, or 4.9 percent of the region's overall surface area. The district was a part of the former Ahafo Ano District Council (Zainul-Deen 2011).

Due to the district's location within the Ashanti Region, it is possible to interact and coordinate with surrounding areas. In search of better job possibilities, the youth of the district frequently move to cities like Kumasi and Sunyani. Petty traders, farmers, chainsaw operators, miners, and other market participants have access to markets because of the area's proximity to Kumasi and Sunyani. However, because of their proximity to Kumasi and Sunyani, certain towns in the district benefit from relatively better basic services and facilities (Atampugre et al. 2022).

The terrain is primarily undulating, with a series of hills running from west to northeast as its most noticeable characteristic. At 2,500 feet (763 meters) above sea level, comprising the Aya, Kwamisa, and Tinte Hills, is where the district's highest point is located. The Mankran, Offin, Abu, and Aboabo, as well as their tributaries, are the district's principal rivers (Atampugre et al. 2022).

A humid semi-equatorial climate prevails in the region. The bulk of the rainy season runs from March through July, culminating in May. Throughout the year, the typical monthly temperature varies between 26°C and 28°C, with the mean yearly temperature hovering around 27°C. The dry season typically lasts from December through March and has relative humidity levels between 70 and 75 percent. There is approximately 1,700 – 1,850 mm of yearly rainfall (Zainul-Deen 2011).

The district's vegetation is primarily tropical rainforest with moist semi-deciduous characteristics. Big and tall trees of many different sorts, including Wawa, Ofram, Sapele,

Mahogany and Odum, can thrive thanks to the vegetation and various soil types. Tropical hardwoods including Wawa, Esa, Kyenkyen, Odum, Ofram, Fununtum, and Kokrodua are abundant in the forest reserves. Moisture-rich semideciduous vegetation dominates the area. Tano Offin and Tinte Bepo Forest Reserve are the two primary forest reserves in the district, which assist protect the wildlife and vegetation (Ntiamoa-Baidu et al. 2010).

The Kumasi-Offin Dwinyama-Bechemso areas are rich in natural resources like rocks and minerals like granite, clay, sand, gold, bauxite, and manganese reserves. Due to their hardness, the granite rocks, which include minerals like gold and bauxite, are used as a source of building materials (Atampugre et al. 2022).

The Forest Ochrosols, a reddish-brown and well-drained soil type, are the predominant soil type in the area. The humus level is high, and they are quite fertile. In general, the district's soils are rich in fertility and ideal for farming. There is a lot of deep, arable soil that can support a variety of monetary, dietary, and horticultural crops. These productive fields also yield vegetables, pear, banana, mango, plantain, sugarcane, citrus, cowpeas, cola, oil palm, maize, cassava, cocoyam, and rice (Borden et al. 2021).

3.2 Research Design

Structured and semi-structured questionnaires were used to collect data from primary and secondary sources for the study. The questionnaire was used to collect crucial information from cocoa producers in the Ahafo Ano South-West District. The research strategy included qualitative and quantitative methods to fully capture the perspectives of the cocoa growers in this region. While qualitative data is not core of the research approach, the author had personal conversation with group and opinion leaders in the study area to understand the dynamics of cocoa production that might not be captured in the structured questionnaire. The information was helpful in explaining and discussion the study's results.

3.3 Data Collection Methods

3.3.1 Study Communities

The study was carried out in 27 communities, namely, Abasua, Achiase, Achiase Dotiem, Adiembra, Adukrom, Afreseni, Ango, Apatratom, Aponaponso, Asourko, Asourko old, Barniekrom, Betinko, Bokuruwa, Bonkwaso, Desereagya, Domeabra, Dunyan Nkwanta,

Kunsu Doteim, Kwabekuma, Manhyia, Mankranso, Ntikrom, Offinso, Ohiapae, Osei krom, and Sabronum.

The criteria used in selection of the communities and respondents:

- Communities in which cocoa production is predominant.
- A cocoa farmer residing in the Ahafo Ano South-West District.
- Willingness of a cocoa farmer to participate in the survey.

3.3.2 Sample size

The total population of the study area (Ahafo Ano South-West District) is 65,770 (Ghana Population and Housing census, 2020). There are no readily available number of cocoa producing households in the district. However, knowing the total population is 65, 770, about 400 respondents would be required (Yamane 1967). A total of four hundred and sixteen (416) cocoa farmers were randomly selected and interviewed.

3.3.3 Sampling Technique and Interview

Purposive sampling and random sampling techniques were used to collect the data from the farmers in the communities. Purposive sampling was used to determine the district, and specifically smallholder cocoa producers because they are the focus of the study. Ahafo Ano South-West District is one of the main cocoa producing areas in Ghana. Questionnaires were designed using clear and easy to understand questions to collect the information from cocoa farmers. The data collected provided information on the socio-economic characteristics of the cocoa farmers (gender, age, education level, marital status, years of farming and family size), output or yield of cocoa and other factors such as farm size, input sources, land, labour, tenure, capital/credit facilities, road accessibilities, membership, number of extension contacts, pests and diseases, and years of cocoa trees in the farm, mass spraying exercise, farming practices and cultural practices used. The data were collected with assistance of enumerators and community opinion leaders.

3.4 Data Analysis and Presentation of Results

Data was presented using descriptive statistics such as frequency, percentages, inferential statistics such analysis of the variance (ANOVA). The Statistical Package for Social Sciences (SPSS) software was used to analyse the data.

Chapter Four

4 Results

4.1 The Socio-Economic Profile of Respondents

This section examines the demographic details of the respondents who were surveyed in the field for the study. Even though this part may not directly address the study's primary objectives, it nonetheless offers helpful details that support the observed results.

4.1.1 Gender Distribution of Respondents

More male than females are involved in cocoa production in the study area. This notwithstanding, efforts were made to ensure fair gender representation although gender dynamics is not the focus of the study. Out of the 416 individuals who were interviewed, 268 (64.42%) were men, while the remaining 148 (35.58%) were women.

Table 1: Gender of Respondents

Sex	Frequency	Percentage
Male	268	64.42
Female	148	35.58
Total	416	100

4.1.2 Age Distribution of Respondents

Table 2 shows the findings of the respondents' age distribution. The highest number observed was 127 (30.53%) people who were between the ages 50 and 59 and the lowest was 17 (4.09%) people who were between the ages of 20 and 29. It shows older people are those involved in the cocoa production. It appears the youth appear are not involved agricultural production and especially cocoa production, although cocoa production is manpower-driven that requires younger people to work on the farms. It is important to initiate policies and specific youth intervention to motivate young people to venture into cocoa production if Ghana is to sustain its foreign earning from cocoa export in the future.

Table 2: Age of the respondents

Age	Frequency	Percentage
20 – 29	17	4.09
30 – 39	84	20.19
40 – 49	108	25.96
50 – 59	127	30.53
60 and above	80	19.23
Total	416	100

4.1.3 Educational background

The level of education of the respondents are reported in Table 3. The majority of the respondents, 26.68% (111 people) had Junior High School (J.H.S) education, 25% (104 people) had primary education, 25% (104 people) had no education at all, 19.23% (80 people) had Senior High School (S.H.S) education, and 4.09% (17) people had a tertiary degree. Junior High School (J.H.S) is 12 years of formal education. This according to literature is adequate to enable a smallholder farmer to effectively use technologies and manage his or her farm. But cocoa production is technology driven, so it would have been more appropriate to find more highly educated farmers. This notwithstanding, interventions can be implemented through agricultural extension service programmes to improve the skills and knowledge of the farmers.

Table 3: Educational level of respondents

Educational level	Frequency	Percentage
No formal education	104	25
Primary	104	25
J.H.S	111	26.68
S.H.S	80	19.23
Tertiary	17	4.09
Total	416	100

4.1.4 Family Size of Respondents

Most smallholder cocoa producers rely on family for farm operations. This makes farmers to have large family sizes so that they can rely on them for farm work. In Table 4 are the respondents' family size. Famers with 4 – 6 family size formed the highest percentage of 56.25%, followed by those with 1 – 3 family size which accounted for 23.80%, and lastly, those with 7 or more family size which was 19.95%. While farmers continue to rely on household members for farm works, it important for policy to consider smallholder cocoa production mechanisation to reduce the drudgery associated to the production process.

Table 4: Family Size of Respondents

Family Size	Frequency	Percentage
1 – 3	99	23.80
4 – 6	234	56.25
7 or more	83	19.95
Total	416	100

4.1.5 Access to Credit

Farmers in cocoa production, whether small or large scale needs financial resources to purchase or make payments for inputs such as fertilizers, weedicides, and cost of labour. Where financial resources are unavailable, productivity is affected, as farmers cannot pay for the required quantity of fertilizers and other inputs. The research asked whether farmers have access to credit. Table 5 displays the findings of the respondents' access to credit (either through borrowing from banks or non-bank financial entities). Three hundred and fourteen (55.48%) of the participants lacked access to credit. This suggests that only 102 (24.52%) of the farmers surveyed had access to credit. The lack of credit by the farmers can affect their productivity. In the absence of credit and savings, farmers cannot pay for farm inputs and other services like labour that are required to ensure improved productivity and output. It is important for policymakers, NGOs to collaborate with private sector financial service providers to bring their services closer to the rural farmers. This will assist farmers to have access to financial service.

Table 5: Respondents Access to Credit

Credit Accessibility	Frequency	Percentage
No Access to Credit to Credit	314	75.48
Access	102	24.52
Total	416	100

4.1.6 Farm Size of Respondents

Most cocoa growers in Ghana are small-scale landowners who rent or use family estates. As a result, the farms are not very large. The farm sizes of the respondents are reported in Table 6. About 354 (85.10%) of the farmers held plots between 1 and 10 acres. Typically, the farmers do not have extensive plantings. Large plantations owned by the government in the past were sold to private farmers and businesses. No more than 1% of farmers had farms larger than 20 hectares and 12.42% had 11-20 hectares. This means most of the cocoa producers in the study are smallholders and policy must focus in addressing smallholder challenges.

Table 6: Farm Size of Respondents

Farm Size	Frequency	Percentage
1 – 10	354	85.10
11 – 20	60	14.42
Above 20	2	0.48
Total	416	100

4.1.7 Availability of Cooperatives

Table 7 displays the availability of farmer cooperatives in the farmers' community. Three hundred and forty-three (82.45%) farmers have farmer cooperatives in their communities. Seventy-three (17.55%) farmers have no farmer cooperatives in their communities. The cooperatives are voluntary farmer organizations that pool their resources, expertise, and efforts to accomplish common objectives and improve their economic well-being. The nature of the state's buying of cocoa beans necessitates farmers' participation in cooperatives,

through which cocoa production support programs and technologies are distributed to farmers. This makes it easier for producing buying companies (companies licensed by the state to buy cocoa beans) to contact farmers, and it also allows NGOs and development agencies to provide assistance to farmers more easily than on an individual basis.

Table 7: Availability of Cooperatives

Farmer Cooperatives	Frequency	Percentage
Availability of Cooperatives	343	82.45
No Cooperatives	73	17.55
Total	416	100

4.1.8 Membership of Association

Aside from cocoa cooperatives, farmers can join large cocoa interest unions. These are larger union groups concerned with the well-being of cocoa farmers. Such associations or unions can advocate for policy changes and interventions to address the challenges faced by smallholder cocoa farmers. As a result, the study wants to know if the farmers are members of these associations or unions. Table 8 displays the results. Most respondents, 219 farmers (52.64%) said they belonged to a cocoa producer association such the Kuapa Kokoo Farmer Union or the Cocoa Abrabopa Association. Members of these associations receive instruction on cocoa cultivation and can discuss important topics relating to cocoa production. 197 farmers said they do not belong to any cocoa producer association. Cooperatives appear to be more locally based than unions, and as a result, most of farmers participate in their activities. This could explain why 82.45% of farmers belong to cooperatives and 52.64% belong to producers' associations or unions.

Table 8: Membership of Association

Membership	Frequency	Percentage
Membership of Association	219	52.64
No Membership	197	47.36
Total	416	100

4.1.9 Land Ownership

Land ownership and access are central to agricultural production, including cocoa production. Most of the land in Ghana and the study area is owned by families, and individuals may inherit from their ancestors. Migrants rarely own land but can obtain one through a share cropping or lease. Productivity may be affected by the type of land ownership. For example, farmers who own their land (typically indigenous people) will put in the utmost effort in farm operations because they know they will reap all the benefits. As a result, the study sought to comprehend the type of land ownership in the study area. Table 9 displays the findings of the land ownership status of the respondents. Two hundred and seventy-four (65.87%) farmers own the land they use to farm. This suggests that only 34.13% of the farmers surveyed do not have their own land. This means that the majority of the cocoa farmers in the communities are indigenous people who may have inherited the land from family members. Migrants' access to land remains a challenge that would necessitate policy attention. Their access to land may promote integration and increase cocoa production in the study area.

Table 9: Land Ownership

Land Ownership	Frequency	Percentage
Landowner	274	65.87
Not Landowner	142	34.13
Total	416	100

4.1.10 Access to Extension Officers

Table 10 displays the farmers' access to extension officers. Three hundred and fifty-nine (86.30%) famers have access to extension officers. Fifty-seven (13.70%) farmers had no access to extension officers. These extension agents work for COCOBOD, the ministry of food and agriculture. They typically offered advice on how to approach a specific issue, such as how to apply fertilizer or effectively control disease and pests on a farm.

Table 10: Access to Extension Officers

Extension Officers	Frequency	Percentage
Access	359	86.30
No Access	57	13.70
Total	416	100

4.1.11 Frequency of Extension Advice

Most farmers were visited Two hundred and seven (61.78%) times in a year by extension officers. These visits can be on-farm, group visit, or home visits. One hundred and seventeen (28.13%) farmers had no visits.

Table 11: Frequency of Extension advice

Extension Visits	Frequency	Percentage
0	117	28.13
1 – 3	257	61.78
4 – 6	33	7.93
7 and above	9	2.16
Total	416	100

4.2 Analysis of Variance (With a Significance Level of 5%)

Analysis of the Variance (ANOVA and MANOVA) was performed for the three variables of interest for the study, land ownership, access to credit and group membership. The results are reported in Table 12. A p value of 0.0078 is reported for the analysis. In addition, tests for the interactive terms are also reported in Table 12. Results show that land ownership had a p

value of 0.3768, group membership had a p value of 0.0386**, credit accessibility had a p value of 0.1632. The interactions of group membership and land ownership had a p value of 0.2953, group membership and credit accessibility had a p value of 0.2580, and group membership, land ownership and access to credit had a p value of 0.4648. Only group membership and land ownership-access to credit interaction show a statistically significance in explanation the variations in cocoa yield.

Table 12: Analysis of Variance

Source	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**
Model	8	6036546	862364	2.7783
Error	408	126642287	310398	**Prob > F**
Total	416	132678833		0.0078***

Table 13: Effect Tests

Source	**Nparm**	**DF**	**Sum of Squares**	**F Ratio**	**Prob > F**
Ownershipstatus	1	1	243021.0	0.7829	0.3768
Membership	1	1	1336490.8	4.3057	0.0386**
Accesstocredit	1	1	605829.3	1.9518	0.1632
Membership*Ownershipstatus	1	1	340847.6	1.0981	0.2953
Membership*Accesstocredit	1	1	398310.4	1.2832	0.2580
Ownershipstat*Accesstocredit	1	1	1645855.0	5.3024	0.0218**
Membership*Ownershipstatus*Accesstocredit	1	1	166126.4	0.5352	0.4648

4.2.1 Robustness Check on Group Membership Factor

This is to test the robustness of the estimates, a Tukey's HSD comparison test below. This enables the study to determine where the results are spurious. The results showed a *p*-value

of 0.0386 (Table 14), implying that group membership (farmers who are part of a group membership) is consistent in explaining the variations in cocoa yield.

Table 14: All Pairwise Differences

Member	Member	Difference	Std Error	T Ratio	Prob>|T|	Lower 95%	Upper 95%
0	1	-145.367	70.05554	-2.08	0.0386*	-283.082	-7.65221

Chapter Five

5 Discussions

5.1 The Socio-Economic Profile of Respondents

According to the survey, there were more male respondents (64.42%) than female respondents (35.58%). This trend can be the result of the fact that the majority of tasks involved in producing cocoa required people who were energetic and strong in the cocoa growing industry. According to Addai (2013), the lack of women working in the cocoa industry might be partly attributed to Ghanaian customs, which often demand that assets like land and money be given to males in the family. Ages of active cocoa growers ranged from 50 to 59, which represented 30.53% of the total, and from 40 to 49, which represented 25.96%. This implies that the majority of farmers are in their middle to late years of life. Most (26.68%) of the farmers have about twelve years of formal education and 25.00% had no formal education.

5.2 Land Ownership

Analysis showed that land ownership had a p value of 0.3768. This means that land ownership alone does not have a statistically significant effect on cocoa yield. The results suggest a statistically not significant between land ownership and the yield of cocoa and disagrees with the stated hypothesis that in comparison with farmers who lack official land ownership documents, those who have secured land tenure and legal proof of ownership will probably produce more cocoa. This conclusion supports that of Asare et al. (2019).

5.3 Group Membership

The p value of 0.0386** was observed for group membership. This means that group membership alone has a statistically significant effect on the yield of cocoa. The outcomes demonstrated that the relationship between group membership and cocoa yield is positive and supports the proposed hypothesis that the production of cocoa is increased when farmers are members of crop producer groups or association because they have access to information, knowledge, and best practices in agriculture. This conclusion supports that of Board (2018); Agbenyo et al. (2022); Aidoo and Fromm (2015); and Ehiakpor et al. (2016).

5.4 Credit Accessibility

Credit accessibility showed a p value of 0.1632. This indicates that, after the investigation, credit availability alone has no impact on cocoa yield. The finding did not meet the hypothesis that having access to credit and other financial resources enhances a farmer's likelihood of investing in better cocoa-growing methods, which improves cocoa yield. Instead, the showed an insignificant relationship between credit accessibility and cocoa yield. However, this finding is supported by that of Obuobisa-Darko (2015).

5.5 Group Membership and Land Ownership

The study wanted to find out whether owning a land and being a member of cocoa producing group at the same could significantly affect cocoa yield. Group membership-land ownership interaction had a p value of 0.2953This shows that the results of the investigation show that land ownership and group membership alone have little impact on cocoa yield. The results reject the hypothesis that farmers who have acquired land tenure with legal proof of ownership and are members of a farming organization will likely produce more cocoa than farmers who do not have these documents or crop membership. However, the data demonstrate a bad correlation between cocoa yield, land ownership, and group membership. This analysis backs up the findings of Asare et al. (2019).

5.6 Group Membership and Credit Accessibility

Group membership-credit accessibility interaction which means, a smallholder cocoa farmer belongs to a group and have access to credit had p value of 0.2580. This indicates that, after the analysis, group membership and credit accessibility interaction had no effect on cocoa yield. The finding is contrary to the notion that group membership and credit accessibility improve a farmer's chances of investing in better cocoa-growing techniques, which boosts cocoa production. Instead, the data show a not significant association between group membership, credit accessibility, and cocoa yield. This conclusion supports that of Obuobisa-Darko (2015).

5.7 Land Ownership and Access to Credit

The p value of 0.0218** was reported for credit availability and land ownership interaction. According to the investigation, having access to credit and owning land both significantly

influence cocoa yield. The findings showed a positive relationship between land ownership, credit availability, and cocoa yield and supports the hypothesis that farmers with official land ownership documents and credit availability are more likely to invest in improved cocoa-growing practices, which enhances cocoa production. The findings of Board (2018); Agbenyo et al. (2022); Aidoo and Fromm (2015); and Ehiakpor et al. (2016) are supported by this conclusion.

5.8 Group Membership, Land Ownership and Access to Credit

The p value for access to credit, land ownership, and crop participation was 0.4648. This shows that after the analysis, crop membership, land ownership, and credit accessibility had no interaction statistically significant effect on cocoa yield. The results refute the claim that crop membership, land ownership, and credit accessibility will significantly affect cocoa production.

5.9 Summary

5.9.1 Analysis of Variance (With a Significance Level of 5%)

A p value of 0.0078 suggests there is an overall significance of the model. Thus, at least one of the factors (land ownership, credit accessibility, and group memberships) in consideration affects the yield. Further effect tests outputs were explored to find out more about the prior statement. From the effects tests, the p value, 0.4648 for the joint effect of all three factors (land ownership, credit accessibility, and group memberships) on yield was not significant. This suggests all three factors, jointly did not significantly affect yield. However, a p value of 0.0218 suggests that ownership and access to credit jointly affect yield and should not be considered separately in policy decision.

Finally, from the results, it shows group membership on its own affects the yield but when combined with land ownership status of the farmer or farmer's access to credit, it has no effect on yield.

5.9.2 Further Analysis on the Membership Factor

The ANOVA report only displayed that there was a difference where farmers group membership affects yield the most but fails to pinpoint exactly where this difference is between farmers who are part and farmers who are not part of a group. Further analysis using the Tukey HSD comparison test had a p value of 0.0386* which showed that membership 1

(farmers who are part of a group membership) was more efficient than membership 0 (farmers who are not part of group membership) in explaining yield variation.

Chapter Six

6 Conclusions and Recommendations

6.1 Conclusions

This study sought to examine the effect of group membership, access to credit and land ownership on cocoa yield in the Ahafo Ano South-West District. The study used purposive and random sampling techniques to collect data from 416 cocoa farmers in twenty-seven communities in the Ahafo Ano South-West District, Ghana. The results of the study showed that of the three main parameters considered for the study, only group membership had a significant and positive impact on cocoa yield. In addition, access to credit and land ownership interaction had a statistically significant effect on cocoa yield.

6.2 Recommendations

Based on the outcome of the study, it is recommended that:

- The Bank of Ghana should urge financial institutions to make financing available to cocoa farmers. This can be accomplished by making sure that financial institutions who lend to the agriculture sector (especially cocoa) are provided tax incentives.
- Banking institutions should not necessarily require tangible collateral, such as landed properties, to finance loans made to cocoa farmers. Instead, they should come up with creative solutions.
- Farmers should be encouraged to sign up for crop producing group memberships so they may gain access to information, best practices, and understanding about cocoa production.
- To ensure that inputs are used for their intended objectives, credit should primarily take the form of inputs for cocoa farmers.
- To encourage farmers to grow perennial crops, land tenure regimes should be tightly managed by the government.

References

Abubakari Z, van der Molen P, Bennett RM, Kuusaana ED. 2016. Land consolidation, customary lands, and Ghana's Northern Savannah Ecological Zone: An evaluation of the possibilities and pitfalls. Land Use Policy **54**:386–398. Pergamon.

Adu-Acheampong R et al. 2014. The cocoa mirid (Hemiptera: Miridae) problem: evidence to support new recommendations on the timing of insecticide application on cocoa in Ghana. International Journal of Tropical Insect Science **34**:58–71. Cambridge University Press. Available from https://www.cambridge.org/core/journals/international-journal-of-tropical-insect-science/article/abs/cocoa-mirid-hemiptera-miridae-problem-evidence-to-support-new-recommendations-on-the-timing-of-insecticide-application-on-cocoa-in-ghana/7BFBC295EAE06FB7BF2194F19193F489 (accessed April 21, 2023).

Afoakwa EO. 2016. Cocoa processing technology. Chocolate Science and Technology:102–116. John Wiley & Sons, Ltd. Available from https://www.researchgate.net/publication/316225062_Cocoa_processing_technology (accessed April 21, 2023).

Aggrey JJ, Ros-Tonen MAF, Asubonteng KO. 2021. Using Participatory Spatial Tools to Unravel Community Perceptions of Land-Use Dynamics in a Mine-Expanding Landscape in Ghana. Environmental Management **68**:720–737. Springer. Available from https://link.springer.com/article/10.1007/s00267-021-01494-7 (accessed April 21, 2023).

Agyei EK, Koomson ESB, Akrasi E. 2021, August 14. The Role of Procurement in Quality Management of Ghana COCOBOD, Ghana. Available from https://papers.ssrn.com/abstract=3905141 (accessed April 21, 2023).

Ahoa E, Kassahun A, Tekinerdogan B. 2020. Business processes and information systems in the Ghana cocoa supply chain: A survey study. NJAS - Wageningen Journal of Life Sciences **92**:100323. No longer published by Elsevier.

Aidoo R, Fromm I. 2015. Willingness to adopt certifications and sustainable production methods among small-scale cocoa farmers in the Ashanti region of Ghana. Journal of Sustainable Development **8**:33–43. Canadian Center of Science and Education.

Akrofi E. 2014. A precedent-setting case of allodial ownership of customary land in Ghana.

Akrofi-Atitianti F, Ifejika Speranza C, Bockel L, Asare R. 2018. Assessing Climate Smart Agriculture and Its Determinants of Practice in Ghana: A Case of the Cocoa Production System. Land **7**. MDPI.

Ali EB, Awuni JA, Danso-Abbeam G. 2018. Determinants of fertilizer adoption among smallholder cocoa farmers in the Western Region of Ghana. Cogent Food and Agriculture **4**. Informa Healthcare. Available from https://www.tandfonline.com/action/journalInformation?journalCode=oafa20 (accessed April 21, 2023).

Amankwah-Amoah J. 2015. Solar Energy in Sub-Saharan Africa: The Challenges and Opportunities of Technological Leapfrogging. Thunderbird International Business Review **57**:15–31. John Wiley & Sons, Ltd. Available from https://onlinelibrary.wiley.com/doi/full/10.1002/tie.21677 (accessed April 21, 2023).

Amankwah-Amoah J, Debrah YA, Nuertey D. 2018. Institutional Legitimacy, Cross-Border Trade and Institutional Voids: Insights from the Cocoa Industry in Ghana. Journal of Rural Studies **58**:136–145. Pergamon.

Amanor KS, Yaro JA, Teye JK. 2020. Working Paper LONG-TERM CHANGE AND AGRICULTURAL COMMERCIALISATION IN GHANAIAN COCOA.

Ameyaw GA, Dzahini-Obiatey HK, Domfeh O. 2014. Perspectives on cocoa swollen shoot virus disease (CSSVD) management in Ghana. Crop Protection **65**:64–70. Elsevier.

Ameyaw GA, Dzahini-Obiatey HK, Domfeh O, Oppong FK, Abaka-Ewusie K. 2015. History and data analyses of 'cutting out' method for cocoa swollen shoot virus disease (CSSVD) control in Ghana. Journal of Plant Diseases and Protection **122**:200–206.

Verlag Eugen Ulmer. Available from https://link.springer.com/article/10.1007/BF03356553 (accessed April 21, 2023).

Amoako M. 2020. Communication Strategies and Plans on the Impact of Climate Change on Cocoa Production in Ghana: A Case of COCOBOD. Ghana Institute of Journalism. Available from https://repository.gij.edu.gh/xmlui/handle/gijdr/378 (accessed April 21, 2023).

Amponsah-Doku B, Daymond A, Robinson S, Atuah L, Sizmur T. 2022. Improving soil health and closing the yield gap of cocoa production in Ghana – A review. Scientific African **15**:e01075. Elsevier.

Anaglo J, Boateng S, Boateng C. 2014. Gender and Access to Agricultural Resources by Smallholder Farmers in the Upper West Region of Ghana. Journal of Education and Practice.

Aneani F, Adu-Acheampong R, Sakyi-Dawson O. 2018. Exploring Opportunities for Enhancing Innovation in Agriculture: The Case of Cocoa (Theobroma cacao L.) Production in Ghana. Sustainable Agriculture Research **7**:33–53. Available from https://ageconsearch.umn.edu/record/301221 (accessed April 21, 2023).

Aneani F, Ofori-Frimpong K. 2013. An Analysis of Yield Gap and Some Factors of Cocoa (Theobroma cacao) Yields in Ghana. Sustainable Agriculture Research **2**.

Ansah EO, Kaplowitz MD, Lupi F, Kerr J. 2019. Smallholder participation and procedural compliance with sustainable cocoa certification programs. https://doi.org/10.1080/21683565.2019.1579776 **44**:54–87. Taylor & Francis. Available from https://www.tandfonline.com/doi/abs/10.1080/21683565.2019.1579776 (accessed April 21, 2023).

Antwi-Agyei P, Stringer LC. 2021. Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from northeastern Ghana. Climate Risk Management **32**:100304. Elsevier.

Asaaga FA, Hirons MA, Malhi Y. 2020. Questioning the link between tenure security and sustainable land management in cocoa landscapes in Ghana. World Development **130**:104913. Pergamon.

Asante FA, Amuakwa-Mensah F. 2014. Climate Change and Variability in Ghana: Stocktaking. Climate 2015, Vol. 3, Pages 78-99 **3**:78–99. Multidisciplinary Digital Publishing Institute. Available from https://www.mdpi.com/2225-1154/3/1/78/htm (accessed April 21, 2023).

Asare-Nuamah P, Botchway E, Onumah JA. 2019. Helping the Helpless: Contribution of Rural Extension Services to Smallholder Farmers' Climate Change Adaptive Capacity and Adaptation in Rural Ghana. https://doi.org/10.1177/0973005219876211 **15**:244–268. SAGE PublicationsSage India: New Delhi, India. Available from https://journals.sagepub.com/doi/abs/10.1177/0973005219876211?journalCode=irma (accessed April 21, 2023).

Asiama K, Bennett R, Zevenbergen J. 2017. Participatory Land Administration on Customary Lands: A Practical VGI Experiment in Nanton, Ghana. ISPRS International Journal of Geo-Information 2017, Vol. 6, Page 186 **6**:186. Multidisciplinary Digital Publishing Institute. Available from https://www.mdpi.com/2220-9964/6/7/186/htm (accessed April 22, 2023).

Asiama KO, Arko-Adjei A. 2022. An Experiment into the Role of Participatory GIS in the Adjudication Process of Customary LandsDOI: 10.1080/00396265.2022.2040869. Available from https://doi.org/10.1080/00396265.2022.2040869 (accessed April 21, 2023).

Asigbaase M, Sjogersten S, Lomax BH, Dawoe E. 2019. Tree diversity and its ecological importance value in organic and conventional cocoa agroforests in Ghana. PLOS ONE **14**:e0210557. Public Library of Science. Available from https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0210557 (accessed April 21, 2023).

Astrid Fenger N, Skovmand Bosselmann A, Asare R, de Neergaard A. 2016. The impact of certification on the natural and financial capitals of Ghanaian cocoa farmers. https://doi.org/10.1080/21683565.2016.1258606 **41**:143–166. Taylor & Francis. Available from https://www.tandfonline.com/doi/abs/10.1080/21683565.2016.1258606 (accessed April 21, 2023).

Atampugre G, Mensah E, Boateng E, Mabhaudhi T, Cofie OO. 2022. Situational analysis of a social-ecological landscape in the Ahafo Ano Southwest District of Ghana. International Water Management Institute (IWMI). CGIAR Initiative on West and Central African Food Systems Transformation. Available from https://cgspace.cgiar.org/handle/10568/128221 (accessed April 22, 2023).

Austin G. 2014. Vent for surplus or productivity breakthrough? The Ghanaian cocoa take-off, c. 1890–1936. The Economic History Review **67**:1035–1064. John Wiley & Sons, Ltd. Available from https://onlinelibrary.wiley.com/doi/full/10.1111/1468-0289.12043 (accessed April 21, 2023).

Avane A, Amfo B, Aidoo R, Mensah JO. 2022. Adoption of organic fertilizer for cocoa production in Ghana: Perceptions and determinants. African Journal of Science, Technology, Innovation and Development **14**:718–729. Taylor and Francis Ltd.

Awudzi GK, Asamoah M, Owusu-Ansah F, Hadley P, Hatcher PE, Daymond AJ. 2016. Knowledge and perception of Ghanaian cocoa farmers on mirid control and their willingness to use forecasting systems. International Journal of Tropical Insect Science **36**:22–31. Cambridge University Press. Available from https://www.cambridge.org/core/journals/international-journal-of-tropical-insect-science/article/abs/knowledge-and-perception-of-ghanaian-cocoa-farmers-on-mirid-control-and-their-willingness-to-use-forecasting-systems/5369272CAD8A2CF37C04BC932529A6BF (accessed April 21, 2023).

Baah K, Kidido JK. 2020. Sharecropping arrangement in the contemporary agricultural economy of Ghana: A study of Techiman North District and Sefwi Wiawso Municipality, Ghana. Journal of Planning and Land Management **1**:50–62. University

for Development Studies. Available from https://sddubidsjplm.com/journal/index.php/jplm/article/view/22 (accessed April 21, 2023).

Badrie N, Bekele F, Sikora E, Sikora M. 2014. Cocoa Agronomy, Quality, Nutritional, and Health Aspects. http://dx.doi.org/10.1080/10408398.2012.669428 **55**:620–659. Taylor & Francis. Available from https://www.tandfonline.com/doi/abs/10.1080/10408398.2012.669428 (accessed April 21, 2023).

Baffoe-Asare R, Danquah JA, Annor-Frempong F. 2013. Socioeconomic factors influencing adoption of codapec and cocoa high-tech technologies among small holder farmers in Central Region of Ghana. University of Cape Coast. Available from http://ir.ucc.edu.gh/jspui/handle/123456789/7324 (accessed April 21, 2023).

Baweja P, Kumar S, Kumar G. 2020. Fertilizers and Pesticides: Their Impact on Soil Health and Environment:265–285. Springer, Cham. Available from https://link.springer.com/chapter/10.1007/978-3-030-44364-1_15 (accessed April 21, 2023).

Bayle GK. 2019. Ecological and social impacts of eucalyptus tree plantation on the environment. Journal of Biodiversity Conservation and Bioresource Management **5**:93–104. Bangladesh Journals Online (JOL). Available from https://www.banglajol.info/index.php/jbcbm/article/view/42189 (accessed April 21, 2023).

Benin S, Johnson M, Abokyi E, Ahorbo G, Jimah K, Nasser G, Owusu V, Taabazuing J, Tenga A. 2013. Revisiting Agricultural Input and Farm Support Subsidies in Africa: The Case of Ghana's Mechanization, Fertilizer, Block Farms, and Marketing Programs. SSRN Electronic JournalDOI: 10.2139/SSRN.2373185. Elsevier BV. Available from https://papers.ssrn.com/abstract=2373185 (accessed April 21, 2023).

Bjornlund V, Bjornlund H, Van Rooyen AF. 2020. Why agricultural production in sub-Saharan Africa remains low compared to the rest of the world–a historical perspective.

International Journal of Water Resources Development:1–34. Routledge. Available from https://www.tandfonline.com/action/journalInformation?journalCode=cijw20 (accessed April 21, 2023).

Board GC. 2018. Manual for cocoa extension in Ghana. Available from https://cgspace.cgiar.org/handle/10568/93355 (accessed April 21, 2023).

Borden RW, Brammer H, Baillie IC, Hallett S. 2021. The contributions of C. F. Charter to tropical soil survey and classification. CATENA **197**:104957. Elsevier.

Bosompem M. 2021. Potential challenges to precision agriculture technologies development in Ghana: scientists' and cocoa extension agents' perspectives. Precision Agriculture **22**:1578–1600. Springer. Available from https://link.springer.com/article/10.1007/s11119-021-09801-2 (accessed April 21, 2023).

Bouttes M, Darnhofer I, Martin G. 2019. Converting to organic farming as a way to enhance adaptive capacity. Organic Agriculture **9**:235–247. Springer Netherlands. Available from https://link.springer.com/article/10.1007/s13165-018-0225-y (accessed April 21, 2023).

Clemens Breisinger B, Diao X, Kolavalli S, Thurlow J. 2008, January 1. The Role of Cocoa in Ghana's Future Development. International Food Policy Research Institute (IFPRI). Available from https://www.africaportal.org/publications/the-role-of-cocoa-in-ghanas-future-development/ (accessed April 21, 2023).

D. Ricketts K, G. Turvey C, I. Gómez M. 2014. Value chain approaches to development: Smallholder farmer perceptions of risk and benefits across three cocoa chains in Ghana. Journal of Agribusiness in Developing and Emerging Economies **4**:2–22. Emerald Group Publishing Limited.

Danso-Abbeam G, Baiyegunhi LJS. 2017. Adoption of agrochemical management practices among smallholder cocoa farmers in Ghana. African Journal of Science, Technology, Innovation and Development **9**:717–728. Taylor and Francis Ltd.

de Boer D, Limpens G, Rifin A, Kusnadi N. 2019. Inclusive productive value chains, an overview of Indonesia's cocoa industry. Journal of Agribusiness in Developing and Emerging Economies **9**:439–456. Emerald Group Publishing Ltd.

Deans H, Ros-Tonen MAF, Derkyi M. 2018. Advanced Value Chain Collaboration in Ghana's Cocoa Sector: An Entry Point for Integrated Landscape Approaches? Environmental Management **62**:143–156. Springer New York LLC. Available from https://link.springer.com/article/10.1007/s00267-017-0863-y (accessed April 21, 2023).

Diarra A, Tasie O. 2017. National Implementation of Regional Pesticide Policies in West Africa: Ghana Case Study ReportDOI: 10.22004/AG.ECON.264391. Available from https://ageconsearch.umn.edu/record/264391 (accessed April 21, 2023).

Djokoto JG, Owusu V, Awunyo-Vitor D. 2016. Adoption of organic agriculture: Evidence from cocoa farming in Ghana. Cogent Food and Agriculture **2**:1242181. Informa Healthcare. Available from https://www.tandfonline.com/action/journalInformation?journalCode=oafa20 (accessed April 22, 2023).

Ecker O. 2018. Agricultural transformation and food and nutrition security in Ghana: Does farm production diversity (still) matter for household dietary diversity? Food Policy **79**:271–282. Pergamon.

Effendy, Fardhal Pratama M, Rauf RA, Antara M, Basir-Cyio M, Mahfudz, Muhardi. 2019. Factors influencing the efficiency of cocoa farms: A study to increase income in rural Indonesia. PLOS ONE **14**:e0214569. Public Library of Science. Available from https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0214569 (accessed April 22, 2023).

Essah R, Anand D. 2021. Proposal on Automatic Cocoa Quality Testing and Procurement in Ghana. Asian Journal of Research in Computer Science:132–146. Sciencedomain International.

Fagariba CJ, Song S, Baoro SKGS. 2018. Climate Change Adaptation Strategies and Constraints in Northern Ghana: Evidence of Farmers in Sissala West District.

Sustainability 2018, Vol. 10, Page 1484 **10**:1484. Multidisciplinary Digital Publishing Institute. Available from https://www.mdpi.com/2071-1050/10/5/1484/htm (accessed April 21, 2023).

Fowler MS, Coutel F. 2017. Cocoa beans: from tree to factory. Beckett's Industrial Chocolate Manufacture and Use:9–49. John Wiley & Sons, Ltd. Available from https://onlinelibrary.wiley.com/doi/full/10.1002/9781118923597.ch2 (accessed April 22, 2023).

Frimpong-Manso J, Tham-Agyekum EK, Aidoo DC, Boansi D, Jones EO, Bakang J-EA. 2022. COOPERATIVE MEMBERSHIP STATUS AND ADOPTION OF GOOD AGRONOMIC PRACTICES: EMPIRICAL EVIDENCE FROM COCOA FARMERS IN ATWIMA MPONUA DISTRICT, GHANA. The Bangladesh Journal of Agricultural Economics **43**:1–17. Available from http://bjae.bau.edu.bd/index.php/home/article/view/177 (accessed April 22, 2023).

Fuseini I, Kemp J. 2015. A review of spatial planning in Ghana's socio-economic development trajectory: A sustainable development perspective. Land Use Policy **47**:309–320. Pergamon.

Glin LC, Oosterveer P, Mol APJ. 2015. Governing the Organic Cocoa Network from Ghana: Towards Hybrid Governance Arrangements? Journal of Agrarian Change **15**:43–64. John Wiley & Sons, Ltd. Available from https://onlinelibrary.wiley.com/doi/full/10.1111/joac.12059 (accessed April 22, 2023).

Gyamera DrEA, Domfeh DrO, Ameyaw DrGA. 2022. Cacao Swollen Shoot Viruses in Ghana. https://doi.org/10.1094/PDIS-10-22-2412-FEDOI: 10.1094/PDIS-10-22-2412-FE. Scientific Societies. Available from https://apsjournals.apsnet.org/doi/10.1094/PDIS-10-22-2412-FE (accessed April 22, 2023).

Harwich N. 2020. Cocoa and Chocolate Trade Routes.

Hill RV, Vigneri M. 2014. Mainstreaming gender sensitivity in cash crop market supply chains. Gender in Agriculture: Closing the Knowledge Gap:315–342. Springer

Netherlands. Available from https://link.springer.com/chapter/10.1007/978-94-017-8616-4_13 (accessed April 22, 2023).

Hilson G, Garforth C. 2013. 'Everyone Now is Concentrating on the Mining': Drivers and Implications of Rural Economic Transition in the Eastern Region of Ghana. Journal of Development Studies **49**:348–364. Taylor & Francis Journals. Available from https://ideas.repec.org/a/taf/jdevst/v49y2013i3p348-364.html (accessed April 22, 2023).

Holden ST, Otsuka K. 2014. The roles of land tenure reforms and land markets in the context of population growth and land use intensification in Africa. Food Policy **48**:88–97. Pergamon.

Ingram V, van Rijn F, Waarts Y, Gilhuis H. 2018. The Impacts of Cocoa Sustainability Initiatives in West Africa. Sustainability 2018, Vol. 10, Page 4249 **10**:4249. Multidisciplinary Digital Publishing Institute. Available from https://www.mdpi.com/2071-1050/10/11/4249/htm (accessed April 22, 2023).

Johnson Gaither C, Yembilah R, Samar SB. 2019. Tree registration to counter elite capture of forestry benefits in Ghana's Ashanti and Brong Ahafo regions. Land Use Policy **85**:340–349. Pergamon.

Jong A De, Harts-Broekhuis A. 2018. Cocoa production and marketing in Cameroon and Ghana the effects of structural adjustment and liberalization. Agricultural Marketing in Tropical Africa: Contributions of the Netherlands:87–108. Taylor and Francis. Available from https://www.taylorfrancis.com/chapters/edit/10.4324/9780429460265-5/cocoa-production-marketing-cameroon-ghana-ali-de-jong-annelet-harts-broekhuis (accessed April 21, 2023).

Kapstein E, Kim R. 2011. The Socio-Economic Impact of Newmont Ghana Gold Limited.

Kehinde AD, Ogundeji AA. 2022. The simultaneous impact of access to credit and cooperative services on cocoa productivity in South-western Nigeria. Agriculture and Food Security **11**:1–21. BioMed Central Ltd. Available from

https://link.springer.com/articles/10.1186/s40066-021-00351-4 (accessed April 22, 2023).

Kempf A. 2016, January 1. The Pedagogy of Standardized Testing: The Radical Effects of Educational Standardization in the US & Canada. Available from https://www.academia.edu/38532161/The_Pedagogy_of_Standardized_Testing_The_Radical_Effects_of_Educational_Standardization_in_the_US_and_Canada (accessed April 22, 2023).

Kolavalli S, Vigneri M. 2017. The cocoa coast: the board-managed cocoa sector in Ghana. The cocoa coast: the board-managed cocoa sector in Ghana. International Food Policy Research Institute.

Kozicka M, Tacconi F, Horna D, Gotor E. 2018. Forecasting cocoa yields for 2050. Available from https://cgspace.cgiar.org/handle/10568/93236 (accessed April 22, 2023).

Krell NT, Giroux SA, Guido Z, Hannah C, Lopus SE, Caylor KK, Evans TP. 2021. Smallholder farmers' use of mobile phone services in central Kenya. Climate and Development **13**:215–227. Taylor and Francis Ltd. Available from https://www.tandfonline.com/doi/abs/10.1080/17565529.2020.1748847 (accessed April 22, 2023).

Kugbega SK, Aboagye PY. 2021. Farmer-herder conflicts, tenure insecurity and farmer's investment decisions in Agogo, Ghana. Agricultural and Food Economics **9**:1–38. Springer Science and Business Media Deutschland GmbH. Available from https://link.springer.com/articles/10.1186/s40100-021-00186-4 (accessed April 22, 2023).

Kusi LY, Agbeblewu S, Anim IK, Nyarku KM. 2015. The Challenges and Prospects of the Commercial Poultry Industry in Ghana: A Synthesis of Literature. University of Cape Coast. Available from http://ir.ucc.edu.gh/jspui/handle/123456789/4904 (accessed April 22, 2023).

Kuusaana, E. D. 2016. LARGE-SCALE LAND ACQUISITIONS FOR AGRICULTURAL INVESTMENTS IN GHANA - IMPLICATIONS FOR LAND MARKETS AND

SMALLHOLDER FARMERS. Available from http://udsspace.uds.edu.gh:80/handle/123456789/3670 (accessed April 22, 2023).

Kuusaana ED, Eledi JA. 2015. Customary land allocation, urbanization and land use planning in Ghana: Implications for food systems in the Wa Municipality. Land Use Policy **48**:454–466. Pergamon.

Kuusaana MM, Adu-Gyamfi S, Darkwa BD. 2021. Cocoa Production in Ghana (1879-1976). Studia Historiae Oeconomicae **39**:55–76. Adam Mickiewicz University Poznan.

Kyere K. 2018. Changes in cocoa farming system and consequences on production and adaptation to climate change in Ghana. Norwegian University of Life Sciences, Ås. Available from https://nmbu.brage.unit.no/nmbu-xmlui/handle/11250/2567072 (accessed April 22, 2023).

Lambrecht I, Asare S. 2016. The complexity of local tenure systems: A smallholders' perspective on tenure in Ghana. Land Use Policy **58**:251–263. Pergamon.

Laven A, Boomsma M. 2012. Incentives for sustainable cocoa production in Ghana Moving from maximizing outputs to optimizing performance.

Leavy J, Hossain N. 2014. Who Wants to Farm? Youth Aspirations, Opportunities and Rising Food Prices. IDS Working Papers **2014**:1–44. John Wiley & Sons, Ltd. Available from https://onlinelibrary.wiley.com/doi/full/10.1111/j.2040-0209.2014.00439.x (accessed April 22, 2023).

Liliane TN, Charles MS, Liliane TN, Charles MS. 2020. Factors Affecting Yield of Crops. Agronomy - Climate Change and Food SecurityDOI: 10.5772/INTECHOPEN.90672. IntechOpen. Available from https://www.intechopen.com/chapters/70658 (accessed April 22, 2023).

Losch B. 2002. Global Restructuring and Liberalization: Côte d 'Ivoire and the End of the International Cocoa Market? Journal of Agrarian Change **2**:206–227. John Wiley & Sons, Ltd. Available from https://onlinelibrary.wiley.com/doi/full/10.1111/1471-0366.00031 (accessed April 22, 2023).

Luckstead J, Tsiboe F, Nalley LL. 2019. Estimating the economic incentives necessary for eliminating child labor in Ghanaian cocoa production. PLOS ONE **14**:e0217230. Public Library of Science. Available from https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0217230 (accessed April 22, 2023).

Mabe FN, Nashiru S, Mummuni E, Boateng VF. 2019. The nexus between land acquisition and household livelihoods in the Northern region of Ghana. Land Use Policy **85**:357–367. Pergamon.

Manteaw SA, Anaglo JN, Boateng SD, Folitse BY. 2018. How the policy environment influences value chain linkages: a comparative study of cocoa and pineapple in Ghana. Pelita Perkebunan (a Coffee and Cocoa Research Journal) **34**:66–78. Riset Perkebunan Nusantara.

Mantey J, Nyarko KB, Owusu-Nimo F, Awua KA, Bempah CK, Amankwah RK, Akatu WE, Appiah-Effah E. 2020. Influence of illegal artisanal small-scale gold mining operations (galamsey) on oil and grease (O/G) concentrations in three hotspot assemblies of Western Region, Ghana. Environmental Pollution **263**:114251. Elsevier.

Mensah AK, Mahiri IO, Owusu O, Mireku OD, Wireko I, Kissi EA. 2015. Environmental Impacts of Mining: A Study of Mining Communities in Ghana. Applied Ecology and Environmental Sciences, Vol. 3, 2015, Pages 81-94 **3**:81–94. Science and Education Publishing. Available from http://pubs.sciepub.com/aees/3/3/3/index.html (accessed April 22, 2023).

Migheli M. 2021. Income, wealth and use of personal protection equipment in the Mekong Delta. Environmental Science and Pollution Research **28**:39920–39937. Springer Science and Business Media Deutschland GmbH. Available from https://link.springer.com/article/10.1007/s11356-021-13449-w (accessed April 22, 2023).

Musah S, Medeni TD, Soylu D. 2019. Assessment of Role of Innovative Technology through Blockchain Technology in Ghana's Cocoa Beans Food Supply Chains. 3rd International

Symposium on Multidisciplinary Studies and Innovative Technologies, ISMSIT 2019 - ProceedingsDOI: 10.1109/ISMSIT.2019.8932936. Institute of Electrical and Electronics Engineers Inc.

Naab FZ, Abubakari Z, Ahmed A. 2019. The role of climate services in agricultural productivity in Ghana: The perspectives of farmers and institutions. Climate Services **13**:24–32. Elsevier.

Nair KP. 2021. Cocoa (Theobroma cacao L.). Tree Crops:153–213. Springer, Cham. Available from https://link.springer.com/chapter/10.1007/978-3-030-62140-7_5 (accessed April 22, 2023).

Nguyen TT, Bauer S, Grote U. 2016. Does Land Tenure Security Promote Manure Use by Farm Households in Vietnam? Sustainability 2016, Vol. 8, Page 178 **8**:178. Multidisciplinary Digital Publishing Institute. Available from https://www.mdpi.com/2071-1050/8/2/178/htm (accessed April 22, 2023).

Norgrove L, Hauser S. 2015. Estimating the Consequences of Fire Exclusion for Food Crop Production, Soil Fertility, and Fallow Recovery in Shifting Cultivation Landscapes in the Humid Tropics. Environmental Management **55**:536–549. Springer New York LLC. Available from https://link.springer.com/article/10.1007/s00267-014-0431-7 (accessed April 22, 2023).

Ntiamoa-Baidu Y, Owusu EH, Asamoah S, Owusu-Boateng K. 2010. Distribution and abundance of forest birds in Ghana. http://dx.doi.org/10.1080/00306525.2000.9639925 **71**:262–268. Taylor & Francis Group . Available from https://www.tandfonline.com/doi/abs/10.1080/00306525.2000.9639925 (accessed April 22, 2023).

Obeng Adomaa F, Vellema S, Slingerland M, Asare R. 2022. The adoption problem is a matter of fit: tracing the travel of pruning practices from research to farm in Ghana's cocoa sector. Agriculture and Human Values **39**:921–935. Springer Science and Business Media B.V. Available from https://link.springer.com/article/10.1007/s10460-021-10292-0 (accessed April 22, 2023).

Obour PB, Owusu K, Agyeman EA, Ahenkan A, Madrid ÀN. 2015. The impacts of dams on local livelihoods: a study of the Bui Hydroelectric Project in Ghana. http://dx.doi.org/10.1080/07900627.2015.1022892 **32**:286–300. Routledge. Available from https://www.tandfonline.com/doi/abs/10.1080/07900627.2015.1022892 (accessed April 22, 2023).

Obuobisa-Darko E. 2015. Credit Access and Adoption of Cocoa Research Innovations in Ghana. Online) **5**:2225–0484. Available from www.iiste.org (accessed April 22, 2023).

Okoffo ED, Denkyirah EK, Adu DT, Fosu-Mensah BY. 2016a. A double-hurdle model estimation of cocoa farmers' willingness to pay for crop insurance in Ghana. SpringerPlus **5**:1–19. SpringerOpen. Available from https://springerplus.springeropen.com/articles/10.1186/s40064-016-2561-2 (accessed April 22, 2023).

Okoffo ED, Fosu-Mensah BY, Gordon C. 2016b. Persistent organochlorine pesticide residues in cocoa beans from Ghana, a concern for public health. International Journal of Food Contamination **3**:1–11. BioMed Central Ltd. Available from https://foodsafetyandrisk.biomedcentral.com/articles/10.1186/s40550-016-0028-4 (accessed April 22, 2023).

Onumah JA, Williams PA, Quaye W, Akuffobea M, Onumah EE. 2014. Smallholder Cocoa Farmers Access to On/Off-Farm Support Services and its Contribution to Output in the Eastern Region of Ghana. Asian Journal of Agriculture and Rural Development **4**:484–495. Available from https://ageconsearch.umn.edu/record/198429 (accessed April 22, 2023).

Opoku M. 2016. HYBRIDITY IN PUBLIC MANAGEMENT: The Consequences of its Adoption in Public Sector Management in Ghana. Available from https://osuva.uwasa.fi/handle/10024/3837 (accessed April 22, 2023).

Otchere AF, Annan J, Quansah E. 2013. Assessing the Challenges and Implementation of Supply Chain Integration in the Cocoa Industry: a factor of Cocoa Farmers in Ashanti

Region of Ghana. International Journal of Business and Social Science **4**. Available from www.ijbssnet.com (accessed April 22, 2023).

Owusu G, Dilys E, Maccarthy S. 2020. Situational analysis study for the agriculture sector in Ghana. Available from https://cgspace.cgiar.org/handle/10568/111562 (accessed April 21, 2023).

Paaga DT. 2013. Customary Land Tenure and Its Implications for Land Disputes in Ghana: Cases from Wa, Wechau And Lambussie. International Journal of Humanities and Social Science **3**. Available from www.ijhssnet.com (accessed April 22, 2023).

Peprah K. 2015. Sustainability of cocoa farmers' livelihoods: A case study of Asunafo District, Ghana. Sustainable Production and Consumption **4**:2–15. Elsevier.

Research Institute (IFPRI) IFP. 2017. The cocoa coast: The board-managed cocoa sector in GhanaDOI: 10.2499/9780896292680. Available from https://ebrary.ifpri.org/digital/collection/p15738coll2/id/132255 (accessed April 22, 2023).

Rioux S. 2013. Book review: Chocolate Nations: Living and Dying for Cocoa in West Africa , by Órla Ryan . Capital & Class **37**:328–330. SAGE Publications.

Roldan MB, Fromm I, Aidoo R. 2013. From Producers to Export Markets: The Case of the Cocoa Value Chain in Ghana. JAD Journal of African Development Fall **15**:2.

Steijn CPA. 2016. Towards sustainable cocoa production: a mixed method assessment of the influence of local governance modes on the farm level impact of private cocoa certification standards in Ghana. Available from https://studenttheses.uu.nl/handle/20.500.12932/23722 (accessed April 22, 2023).

Suh NN, Molua EL. 2022. Cocoa production under climate variability and farm management challenges: Some farmers' perspective. Journal of Agriculture and Food Research **8**:100282. Elsevier.

Takyi SA, Amponsah O, Inkoom DKB, Azunre GA. 2019. Sustaining Ghana's cocoa sector through environmentally smart agricultural practices: an assessment of the

environmental impacts of cocoa production in Ghana. Africa Review **11**:172–189. Brill. Available from https://brill.com/view/journals/bafr/11/2/article-p172_5.xml (accessed April 22, 2023).

Tease F, Johnson Gaither C, Yembilah R, Tsiboe-Darko A, Mensah P, Adams B. 2023. "When Will the Tree Grow for Me to Benefit from It?": Tree Tenure Reform to Counter Mining in Southwestern Ghana. https://doi.org/10.1080/08941920.2022.2161028DOI: 10.1080/08941920.2022.2161028. Routledge. Available from https://www.tandfonline.com/doi/abs/10.1080/08941920.2022.2161028 (accessed April 22, 2023).

Thomas KA, Olajide A, Olutayo MO. 2022. Cocoa Commercialisation in Nigeria: Issues and ProspectsDOI: 10.19088/APRA.2022.001. APRA, Future Agricultures Consortium. Available from https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/17061 (accessed April 22, 2023).

Ton G, Hagelaars G, Laven A, Vellema S. 2008. Chain Governance, Sector Policies and Economic Sustainability in Cocoa: A Comparative Analysis of Ghana, Côte D'Ivoire, and Ecuador. SSRN Electronic JournalDOI: 10.2139/SSRN.1609686. Elsevier BV. Available from https://papers.ssrn.com/abstract=1609686 (accessed April 22, 2023).

Tothmihaly A, Ingram V, von Cramon-Taubadel S. 2019. How Can the Environmental Efficiency of Indonesian Cocoa Farms Be Increased? Ecological Economics **158**:134–145. Elsevier.

Vaast P, Somarriba E. 2014. Trade-offs between crop intensification and ecosystem services: the role of agroforestry in cocoa cultivation. Agroforestry Systems **88**:947–956. Kluwer Academic Publishers. Available from https://link.springer.com/article/10.1007/s10457-014-9762-x (accessed April 22, 2023).

van Huellen S, Abubakar FM. 2021. Potential for Upgrading in Financialised Agri-food Chains: The Case of Ghanaian Cocoa. European Journal of Development Research **33**:227–252. Palgrave Macmillan. Available from

https://link.springer.com/article/10.1057/s41287-020-00351-3 (accessed April 22, 2023).

van Vliet JA, Giller KE. 2017. Mineral Nutrition of Cocoa: A Review. Advances in Agronomy **141**:185–270. Academic Press.

Villacis A, Alwang J, Barrera V. 2022. Cacao value chains and credence attributes: lessons from Ecuador. Journal of Agribusiness in Developing and Emerging Economies **12**:549–566. Emerald Group Holdings Ltd.

Wessel M, Quist-Wessel PMF. 2022. Cocoa production in West Africa, a review and analysis of recent developments. https://doi.org/10.1016/j.njas.2015.09.001 **74–75**:1–7. Taylor & Francis. Available from https://www.tandfonline.com/doi/abs/10.1016/j.njas.2015.09.001 (accessed April 22, 2023).

Wuepper D, Sauer J. 2016. Explaining the performance of contract farming in Ghana: The role of self-efficacy and social capital. Food Policy **62**:11–27. Pergamon.

Yamane, Taro. (1967). Statistics: An Introductory Analysis, 2nd Edition, New York: Harper and Row. (n.d.). Available from http://www.sciepub.com/reference/180098 (accessed April 22, 2023).

Yamoah FA, Kaba JS, Botchie D, Amankwah-Amoah J. 2021. Working towards Sustainable Innovation for Green Waste Benefits: The Role of Awareness of Consequences in the Adoption of Shaded Cocoa Agroforestry in Ghana. Sustainability 2021, Vol. 13, Page 1453 **13**:1453. Multidisciplinary Digital Publishing Institute. Available from https://www.mdpi.com/2071-1050/13/3/1453/htm (accessed April 22, 2023).

Yaro JA. 2013. The perception of and adaptation to climate variability/change in Ghana by small-scale and commercial farmers. Regional Environmental Change **13**:1259–1272. Springer Verlag. Available from https://link.springer.com/article/10.1007/s10113-013-0443-5 (accessed April 22, 2023).

Zainul-Deen BD. 2011. An assessment of Ghana's policy on quality education in the public Senior High Schools: a case study of Ahafo Ano North and South Districts.