CHRISTIAN SERVICE UNIVERSITY COLLEGE

COCOA HEALTH AND EXTENSION DIVISION'S PROGRAMMES AND SUSTAINABLE COCOA PRODUCTION IN GHANA: A CASE OF AHAFO ANO COCOA DISTRICT

BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature ……. Date …….

Name: Frank Osei

Supervisor's Declaration

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

Supervisor's Signature ……. Date …….

Name: Dr. Nicholas Kofi Nti

ABSTRACT

The study set out to investigate the influence of the Cocoa Health and Extension Division's Programmes (CHED) on Sustainable Cocoa Production in Ghana using Ahafo Ano Cocoa District as the setting. CHED extension services were measured with five variables – Teaching and Learning Methods, Facilitating the Adoption of Technology, Formation of Farm Groups, Information Management, and Linkage with Stakeholders. The researcher employs a quantitative research design and utilized Slovin's formula to determine the sample size, resulting in the distribution of survey questions to 399 cocoa farmers within the Ahafo-Ano North Municipality. Due to the nature of the population, the non-probability sampling technique specifically convenient sampling was used to select the respondents. The researcher used descriptive and inferential statistics for the analysis with the help of SPSS version 20. The cocoa farmers expressed their level of agreement on all the Five variables that happens to be the activity areas of CHED and their influence on sustainable cocoa production. The study indicated four out of the five extension activities – Teaching and Learning Method, Facilitating the Adoption of Technology, Formation of Farm Groups, and Linkage with Stakeholders influence Sustainable Cocoa Production in the study area. The researcher made necessary recommendations for future researchers and policymakers in Ghana and abroad.

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DEDICATION

I dedicate this project to God Almighty my Creator, my strong pillar, my source of inspiration, wisdom, knowledge, and understanding. He has been the source of my strength throughout this program and on His wing only have I soared. I also dedicate this work to my father Mr. Kwaku Osei and my mother Mrs. Afua Achiaa Osei for their constant support and prayers, not forgetting Hon. Joseph Agyemang (Agyingo), Abigail Owusu, and Kenneth Ameyaw whose encouragement has made sure that I give it all it takes to finish what I started.

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CHAPTER ONE

INTRODUCTION

The study's tone is established in this chapter. The context of the investigation is presented first, then the problem description, the research aims, and the research questions. The chapter continues with the study's goals and constraints before concluding with how the entire investigation was organized chronologically.

Background to the Study

Globally, it is anticipated that the world's population will reach approximately 9.7 billion by the year 2050. The remarkable growth in population highlights the pivotal role of agricultural development in tackling extreme poverty and hunger while promoting shared prosperity, as discussed by Attipoe et al. in 2021. Agriculture stands as a cornerstone of the global economy, owing to its significant contributions to health, sustainability, and food accessibility. At the international level, the agricultural sector constitutes about 4% of the global gross domestic product (GDP). This figure escalates to approximately 24% of the GDP in developing nations, where it remains the primary source of sustenance, income, and employment for rural populations, as highlighted by Attipoe et al. (2021) and Donkor et al. (2016).

In West Africa, the agricultural sector contributes around 35% to the Gross Domestic Product (GDP), though this percentage varies by country. Moreover, it employs no less than 65% of the total workforce, as reported by Fatty et al. in 2021. For instance, studies have indicated that in Gambia, a substantial 30% of the country's GDP is derived from the agricultural sector. This sector also accounts for 40% of the foreign exchange earnings and employs 70% of the workforce within the nation, as reported by the International Trade Administration in 2022. Sasu (2023) has noted that agriculture is a significant contributor to Nigeria's GDP, making up almost 30%

of the total GDP in 2021. The contribution of the agricultural sector to the economy of Côte d'Ivoire follows a similar trend. According to the World Bank's report in 2019, 23% of Cote d'Ivoire's total GDP is attributed to the sector, and it accounts for two-thirds of all exports. This country is renowned as the world's largest producer of cocoa, representing 40% of the total global cocoa production. Research findings have shown that Ghana's agricultural sector contributed 20.3% to the country's GDP in 2015, with approximately 60% of the nation's population directly or indirectly dependent on agriculture for their livelihood and survival, as emphasized by Anang et al. in 2020 and Donkor et al. in 2016. These statistics underscore the effectiveness of investing in the agricultural sector as a tool for poverty alleviation, particularly in developing countries such as Ghana.

Over the years, scholars have firmly contended that cocoa plays a pivotal role in Ghana's agricultural sector. This assertion is supported by the research of Attipoe et al. (2021) and Donkor et al. (2016), as cocoa, as a sub-sector, contributes to 10% of the gross domestic product and sustains nearly four million livelihoods in the country. It is widely recognized as a major commodity for poverty alleviation. The global demand for cocoa beans has shown a consistent upward trend, prompting successive Ghanaian governments to initiate programs and make deliberate investments in the sector through the Ghana Cocoa Board.

The Ghana Cocoa Board has its origins in the colonial period when the colonial government passed an ordinance in 1947 to establish it, providing an initial working capital of ¢ 27 million old Ghana cedis. Within the Ghana Cocoa Board, an independent department known as the Cocoa Health and Extension Division was established with the primary focus of providing extension services to cocoa farmers in the country. These services aim to enhance farmers' capacity and offer various forms

of support to improve their performance in the sector. It is important to note that the role of extension services extends beyond technology transfer and production enhancement; it encompasses actual training, coaching, and working directly with farmers to achieve positive outcomes, in line with the findings of Attipoe et al. (2021). The investment in extension activities is aimed at addressing the challenges faced by cocoa farmers to ensure sustainable cocoa production in Ghana.

However, recent studies have indicated that approximately 90% of cocoa farmers have experienced low productivity in their cocoa cultivation over the past years, despite the increasing global demand for cocoa beans, as highlighted by Attipoe et al. (2021). This situation calls for a thorough investigation into the extension activities and the adoption behaviors of farmers regarding the implementation of the services provided by the Cocoa Health and Extension Division in their farming practices. The goal of this study is to examine the contributions of the Cocoa Health and Extension Division's programs and institutional support in addressing sustainable cocoa production in Ghana.

Statement of the Problem

Sustainable agricultural production remains a pivotal concern for both developed and developing nations due to its significant role in global food security, employment opportunities, and public health outcomes (International Trade Administration, 2022; Lamin, Ode, & Ahule, 2021; Fatty, Ode, Ahule, et al., 2021; Dlamini & Worth, 2016). In Sub-Saharan Africa, the agricultural sector serves as a primary source of income and employment for many countries within the region. Nonetheless, the sector grapples with substantial challenges, primarily characterized by low yields, leading to a loss of nearly 30% of agricultural produce due to knowledge limitations (Lamin, Ode, & Ahule, 2021). This jeopardizes sustainable

agricultural production since agricultural productivity and yields in this region generally lag behind those of other developing areas worldwide (Fatty, Ode, Ahule, et al., 2021). For instance, studies have revealed that Gambia's agricultural sector faces various difficulties, including land access issues, suboptimal farming practices, and significant post-harvest losses (Lamin, Ode, & Ahule, 2021). Meanwhile, in Nigeria, research has documented that the agricultural sector's productivity is at an all-time low due to factors such as inadequate mechanization, limited fertilizer application, insufficient access to improved seeds, heavy reliance on rain-fed agriculture, and inadequate water management (Fatty, Ode, Ahule, et al., 2021).

In Ghana, Danso-Abbeam et al. (2018) highlighted the pressing concern of agricultural sustainability, particularly given that most farmers are smallholders still employing traditional production techniques, facing shortages of farming inputs, and experiencing a shortage of extension services across all sub-sectors. Despite the cocoa sub-sector's significance in poverty alleviation and its substantial contribution to the gross domestic product and livelihoods of millions (Attipoe et al., 2021), research indicates that it grapples with sustainability issues stemming from subpar yields. Data reveals that the average cocoa yield in Ghana stands at approximately 400 kg/ha, in stark contrast to Malaysia's 1800 kg per hectare (Ehiakpor et al., 2016; Barietos et al., 2008).

To address agricultural sustainability challenges across the continent, both governments and donor agencies have implemented measures such as investments in extension programs. These programs serve as vehicles for disseminating information and educating farmers about modern farming technologies to enhance their knowledge and skills (Attipoe et al., 2021; Gebrehiwot, 2015). The crucial role of agricultural extension in the social and economic development of nations cannot be

understated (Dlamini & Worth, 2016). It's argued that the responsibilities of extension officers extend beyond technology transfer and production improvement, encompassing actual training, coaching, and hands-on support to enable farmers to derive maximum benefits from these programs (Attipoe et al., 2021). Traditionally, agricultural extension has focused on technology transfer from central research units with the aim of boosting agricultural production in the interest of national food security and foreign exchange earnings (Gebrehiwot, 2015).

However, in recent years, a debate among scholars and policymakers has emerged regarding the efficacy of agricultural extension in enhancing agricultural production among small-scale growers (Dlamini & Worth, 2016), with limited discourse on the specific case of Ghana, especially within the cocoa production sector. Hence, this study aims to investigate the impact of the Cocoa Health and Extension Division's Programs and Institutional Support on Sustainable Cocoa Production in Ghana. This research seeks to uncover innovative approaches to agricultural extension and propose a reevaluation and adjustment of cocoa extension models to optimize cocoa farmers' productivity in the country.

Purpose of the Study

The study's objective is to evaluate how cocoa farmers behave toward the programs and institutional support provided by Ghana's Cocoa Health and Extension Division for sustainable cocoa production.

Research Objectives

To achieve the main goal of the study, the following specific objectives are investigated:

1. To assess extension programmes Cocoa Health and Extension Division offers cocoa farmers in the Ahafo-Ano Cocoa District
2. To assess the challenges cocoa farmers face in their farming activities in the Ahafo-Ano Cocoa District
3. To assess the impact of extension programmes of the Cocoa Health and Extension Division on Sustainable Cocoa Production in the Ahafo-Ano Cocoa District

Research Questions

In this study, the researcher examines the behaviour of cocoa farmers towards the extension services of the Cocoa Health and Extension Division's Programmes and Institutional Support on Sustainable Cocoa Production in Ghana. To achieve the research goal, the following questions are investigated:

1. What is the respondent's assessment of the extension programmes Cocoa Health and Extension Division offers to cocoa farmers in the Ahafo-Ano Cocoa District?
2. What are the challenges facing cocoa farmers in the Ahafo-Ano Cocoa District?
3. What is the impact of various extension programmes of the Cocoa Health and Extension Division on Sustainable Cocoa Production in the Ahafo-Ano Cocoa District?

Significance of the Study

The study will provide significant contributions to the following stakeholders:

Ghana Cocoa Board: The results of this study will give the management of the Ghana Cocoa Board useful insight into how to carry out their duties efficiently in

resolving challenges related to sustainable cocoa production in Ghana, especially the welfare of the nation's cocoa farmers.

Cocoa Health and Extension Division: this study will help CHED in tuning their agricultural extension activities to meet the fundamental needs of farmers. It will also provide insightful findings for the division in terms of developing the extension officers' capabilities and skills in addressing the pertinent needs of cocoa farmers in Ghana.

Cocoa Farmers: This study will identify some of the challenges that farmers face in their farming activities and draw the attention of responsible agencies to help address the issues for the farmers.

Educational Institutions: the findings will serve as teaching and learning materials for educational institutions in the country especially agric students and other students who have an interest in agribusiness in Ghana.

Future Researcher: the study will set a tone for a new research direction in the cocoa industry, especially regarding extension activities and sustainable cocoa production in the country.

Theoretical Contribution: The study's findings, in terms of theory, significantly advance the literature on the acceptance and uptake of cocoa extension activities by Cocoa Health and Extension Division officials working in developing nation environments. The research will contribute to a broader understanding of agricultural extension efforts and strategies to make them better in academic literature and discussion.

Delimitations of the Study

This study looks at CHED's agricultural extension programs and how they affect sustainable cocoa production in Ghana's Ahafo-Ano Cocoa District. Improved Teaching and Learning, Fostering Farmer Group Formation, Improving Information Management, Strengthening Stakeholder Linkage, and Facilitating Technology Adoption are some of the extension activities that the study focuses on. By controlling socioeconomic factors like age, gender, marital status, and others, the study also investigates the impact that extension efforts have on Sustainable Cocoa Production in Ghana among cocoa farmers.

Limitations of the Study

Notwithstanding the contribution this study makes to the discourse of cocoa research in the country, the researcher recognizes the following limitations and encourages users of this study to factor them into their decision-making.

First, a convenient sampling technique was used in selecting the respondents of the study. The technique is prone to biases which may affect the outcome of the result although the researcher put adequate measures in place to overcome such biases.

Second, the sample of the study was drawn from cocoa farmers from the Ahafo-Ano Cocoa District. This demonstrates that there is a probability of homogeneity because the cocoa farmers used in the study share common characteristics that may influence their responses.

Finally, the researcher employs a quantitative method for the data collection. Although, studies have demonstrated the robustness of this method in social sciences research, however, getting in-depth knowledge about the respondents is one of the

weaknesses of this method. Therefore, future researchers should apply the mixed method to study the phenomenon.

Definition of Terms

Agricultural Extension is an educational process that produces, disseminates, and uses knowledge or guidance for farm and farm household livelihood development decisions. (Hlatshwayo & Worth, 2019).

Agricultural Extension activities include activities that are essential for increasing teaching and learning, facilitating the use of new technology, encouraging the establishment of farmer groups, enhancing information management, and developing stakeholder relationships.

Sustainable Cocoa Production refers to the constant cocoa supply and generation of income both locally and externally for cocoa farmers and the nation.

Organisation of the Study

The study is structured into five distinct chapters. The subsequent sections detail the organization of these chapters:

Chapter One commences with an introduction to the study, encompassing key elements like the study's background, problem statement, research objectives, research questions, significance, scope, and limitations.

Chapter Two is dedicated to an extensive literature review, covering conceptual reviews, theoretical and conceptual frameworks, and an examination of empirical studies related to agricultural extension services and sustainable cocoa production.

Chapter Three delves into the research methodology, beginning with an exploration of the research design and approach, study area, study population, sample selection and sampling methods, as well as the procedures employed for data collection and analysis.

Chapter Four presents the study's outcomes, aligning them with the research objectives and questions. These results are elucidated through descriptive and inferential analysis and are further contextualized within the relevant literature and hypotheses.

Chapter Five offers a comprehensive synthesis of findings, conclusions drawn from the study, and recommendations intended for stakeholders in the agricultural sector. Additionally, this chapter provides suggestions for future research endeavours.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The current study is positioned within the pertinent literature on agricultural extension initiatives, institutional support, and sustainable cocoa production in this chapter. The essential terminology and concepts of the study are examined first in the literature, which is then followed by a discussion of the study's theoretical underpinnings. The theoretical framework presents the theoretical case for how the Cocoa Health and Extension Division's extension efforts should be conducted to guarantee sustainability in Ghana. To provide a clear outline of how the current study explored the issue, the conceptual framework will be discussed. A review of similar works follows in the next section of the chapter. In light of the goals of this study, it examines the pertinent studies critically. Then a summary of the review of related studies is provided.

Concept Review

Agricultural Extension

Agricultural extension programmes have received much attention in most developing countries. both government and donor agencies have committed resources for funding public extension systems (Gebrehiwot, 2015). Scholars have defined the term from diverse perspectives because of its application to different fields. For instance, Dlamini and Worth, (2016) defined the term extension as information education that aims to disseminate information of relevance with the intent of endorsing knowledge, skills, and aspirations for a behavioural change among a group of people. In the realm of agriculture, agricultural extension can be described as an educational process aimed at creating, disseminating, and applying information or

advice to support decision-making for the improvement of farms and the livelihoods of farming households (Hlatshwayo & Worth, 2019). As per Danso-Abbeam et al. (2018), agricultural extension involves systems that are designed to enhance farmers' and related market actors' access to knowledge, information, and technologies. These systems also promote collaboration with research, education, agribusiness, and relevant institutions while helping individuals develop their technical, organizational, and management skills and practices. Scholars agreed that agricultural extension intends to transfer technology from central research units and increase agricultural productivity in the interest of national food security and foreign exchange revenues, despite the fact that several definitions of the term have been proposed (Danso-Abbeam et al., 2018; Gebrehiwot, 2015).

Agricultural Extension Services

The objective of agricultural extension underscores the importance of providing services to farmers that contribute to the achievement of sustainable agricultural outcomes. According to Gebrehiwot (2015), when designing agricultural extension services, policymakers should take into account essential factors such as training initiatives, technology demonstrations, access to credit services, and the active engagement of farmers. Danso-Abbeam et al. (2018) argue that effective extension services go beyond the mere transfer of technology and productivity enhancement. They also involve enhancing farmers' managerial and technical skills through training, facilitation, and coaching. Anang et al. (2020) emphasize the need to address issues such as ineffective extension service delivery methods, insufficient personnel, and a lack of logistical support and materials to attract and involve farmers in extension programs. Dlamini and Worth (2016) propose a comprehensive approach to extension services, highlighting key elements including the enhancement of

teaching and learning, promotion of farmer group formation, improvement of information management, strengthening of stakeholder linkages, and facilitation of technology adoption.

Cocoa Health and Extension Division

The Cocoa Health and Extension Division (CHED) of the Ghana Cocoa Board, previously known as CSSVD and Cocoa Services Division, has had a diverse history dating back to its establishment in 1945. The initial outbreak of the Cocoa Swollen Shoot Virus Disease (CSSVD) was officially recorded in the 1930s within the Eastern Region and subsequently proliferated throughout Ghana's cocoa-producing areas. Recognizing the severe threat posed by this disease to the cocoa industry, the government established the Cocoa Division as a unit within the Department of Agriculture with the primary goal of controlling CSSVD and managing cocoa pests. In 1972, the Cocoa Division was incorporated into the Ministry of Cocoa Affairs and underwent a name change to become the Cocoa Production Division. Simultaneously, Cocoa Extension, previously under the Ministry of Agriculture until 1972, was transferred to the newly established Ministry of Cocoa.

In July 1979, with the dissolution of the Ministry of Cocoa Affairs, the Cocoa Production Division was placed under the management of the Ghana Cocoa Board (COCOBOD). Following a significant restructuring effort of the Ghana Cocoa Board, its subsidiaries, and divisions in 1985, the Cocoa Production Division was rebranded as the Cocoa Services Division (CSD) and was assigned three primary functions:

i. Controlling the spread of Cocoa Swollen Shoot Virus Disease (CSSVD)
ii. Producing and supplying hybrid seed pods to farmers (cocoa agronomy)

iii. Educating farmers on approved agronomic and cultural practices in cocoa cultivation (cocoa extension).

In response to recommendations from consultants and other working groups, the government decided to consolidate cocoa extension services with the Ministry of Food and Agriculture (MOFA) Extension services in 1998. Consequently, cocoa extension services were transferred to MOFA in 2000, resulting in the dissolution of the Cocoa Services Division. Subsequently, in January 2001, two units were established: the Cocoa Swollen Shoot Virus Disease Control Unit (CSSVD) and the Seed Production Unit (SPU). These units were entrusted with the responsibilities of managing diseased cocoa farms and producing hybrid cocoa seeds for farmers, respectively.

In light of substantial concerns expressed by farmers and other stakeholders about the need for a more effective and efficient extension system for cocoa farmers, the Public-Private Partnership in Cocoa Extension, coordinated by CSSVDCU, was established in early 2010. In April 2014, the CSSVD-CU was elevated to the status of a Division and underwent a name change, becoming the Cocoa Health and Extension Division, with new mandates and responsibilities.

Sustainable Cocoa Production

Sustainability in agriculture is crucial for humanity. Sustainable development, according to Hlatshwayo and Worth (2019), occurs when humankind can make sure that its progress satisfies the demands of the present without endangering the needs of future generations. According to Attipoe et al. (2021), sustainable agriculture entails a steady supply of food and the creation of money for farmers and the country both domestically and abroad. So, those who practice sustainable agriculture want to fulfill

three key goals: a healthy environment, financial success, and social and economic equality. In this framework, sustainable cocoa production aims to guarantee that cocoa farmers have adequate cocoa yields and a sustainable income from their farm activities.

Theoretical Framework

A theoretical framework is considered essential in research because it guides and shapes the entire research process. According to Cherry (2016), a theory or model is the central anchor of a theoretical framework. Awa et al. (2015) defined the term theory as an interconnected idea that is organized to explain a phenomenon. As a result, it holds a crucial role in organizing the amalgamation of thoughts and principles to achieve the overarching objective of a study (Yang, Liu, Li & Yu, 2015). Scholars have posited that theories are formulated to facilitate the elucidation, forecasting, comprehension, or even the challenging of assumptions within established knowledge, with the ultimate goal of broadening the horizons of comprehension. Consequently, a theoretical framework is constructed through the amalgamation of the arguments and presumptions from diverse theories or models, thereby furnishing a more extensive context to steer the research process (Awa et al., 2015; Yang et al., 2015). Research in the domain of agricultural extension and sustainability falls under the purview of the diffusion of innovation, as it addresses issues pertinent to farmers and the nation at large (Awa et al. 2015). Thus, the theory of diffusion of innovations is employed to elucidate these phenomena.

The Theory of Diffusion of Innovations

The theory of diffusion of innovations finds its historical roots in the first half of the 20th century and is closely associated with American sociologist Everett M. Rogers, whose book "Diffusion of Innovations" was published in 1962. This theory

amalgamates concepts and insights from anthropological and sociological perspectives (Hlatshwayo & Worth, 2019). For example, early in the 20th century, American anthropologists conducted studies on the indigenous North Americans to understand their adoption behaviors related to the introduction of the horse and the spread and modification of dance ceremonies (Hlatshwayo & Worth, 2019). Similarly, other scholars examined the diffusion of corn cultivation from America to Europe and the factors influencing Europeans' acceptance of this new product (Fatty et al., 2021). Prominent sociologists explored various aspects, such as the interplay between social and legal trends, the influence of cities on their surrounding areas, and the spread of novel ideas among farmers leading to changes in agricultural practices. These investigations helped theorists identify crucial factors that influence people's decisions to adopt new ideas and effect changes (Lamin, Ode, & Ahule, 2021).

The theory posits that several elements, including the nature of the innovation, the communication methods, the time elapsed, the prospective adopters, and the societal structure, collectively determine whether a particular group will embrace an innovation. The theory clarifies that innovation can take the form of a product, practice, or idea and need not necessarily be a new invention; it must, however, be perceived as new by individuals or other units of adoption. The acceptance of new ideas is also contingent on factors like the innovation's relative advantage, compatibility, adaptability, and complexity (Akrofi-Atitianti et al., 2018). In this study, the agricultural extension services, encompassing activities like seedling transplanting, pruning, fertilizer application, and pest control introduced by the Ghana Cocoa Board and facilitated by the Cocoa Health and Extension Division, are considered as innovations. The rate at which cocoa farmers adopt these innovative practices is instrumental in ensuring sustainable cocoa production in Ghana.

Another essential aspect of the diffusion theory is communication. The reception of an innovation by a targeted group largely depends on the type and nature of communication employed. This communication can influence the structure and functioning of a social system. It is acknowledged that both the communication channels and the change agents play a significant role in the diffusion process. The communication channels can be either face-to-face or mass communication, and the change agents are individuals responsible for introducing innovations to members of a social system. In this present study, the communication aspects involve the methods employed by extension officers in delivering their services, such as training, seminars, rallies, and demonstrations. The change agents are the extension officers from the Cocoa Health and Extension Division working with cocoa farmers in the Ahafo-Ano Cocoa District.

Ultimately, the theory of innovation is intrinsically linked to social systems and the outcomes of adoption. When analyzing the diffusion theory, a critical component is the social systems, which encompass various entities within a social framework. These social systems may comprise individuals, collectives, institutions, or subunits, incorporating both structural and social elements. The structure involves the organized arrangements of these entities, which can vary from the formal hierarchical structure of a bureaucratic organization with established rules and regulations to the influence of norms in less formal groups. Social factors also encompass the decision-making process, whether it is rooted in individual choices, consensus within the community, or authoritative mandates. In this study, the social systems consist of the formation of farmer groups, key stakeholder linkages, and the management of information among cocoa farmers in the Ahafo-Ano Cocoa District.

Conceptual Framework

Based on the theory of diffusion, the following key concepts were identified – innovation, communication, and social systems. Within the conceptual framework, the communication aspect considers the teaching and learning method that the extension officers used to help cocoa farmers to appreciate and adopt the behaviours. Innovation refers to the adoption of technology such as pruning techniques, seedling transplanting methods, etc. Social systems apply to the formation of farmer's groups, linkage of stakeholders, and information management. In the conceptual framework, the following variables are treated as independent variables: the enhancement of teaching and learning, the encouragement of farmer group development, the improvement of information management, the strengthening of stakeholder ties, and the facilitation of technology adoption. The dependent variable is sustainable cocoa production. By controlling socioeconomic characteristics such age, gender, marital status, etc., the study was able to analyze the link between the independent variables and the dependent variable. The conceptual underpinnings of the investigation are shown in Figure 1.

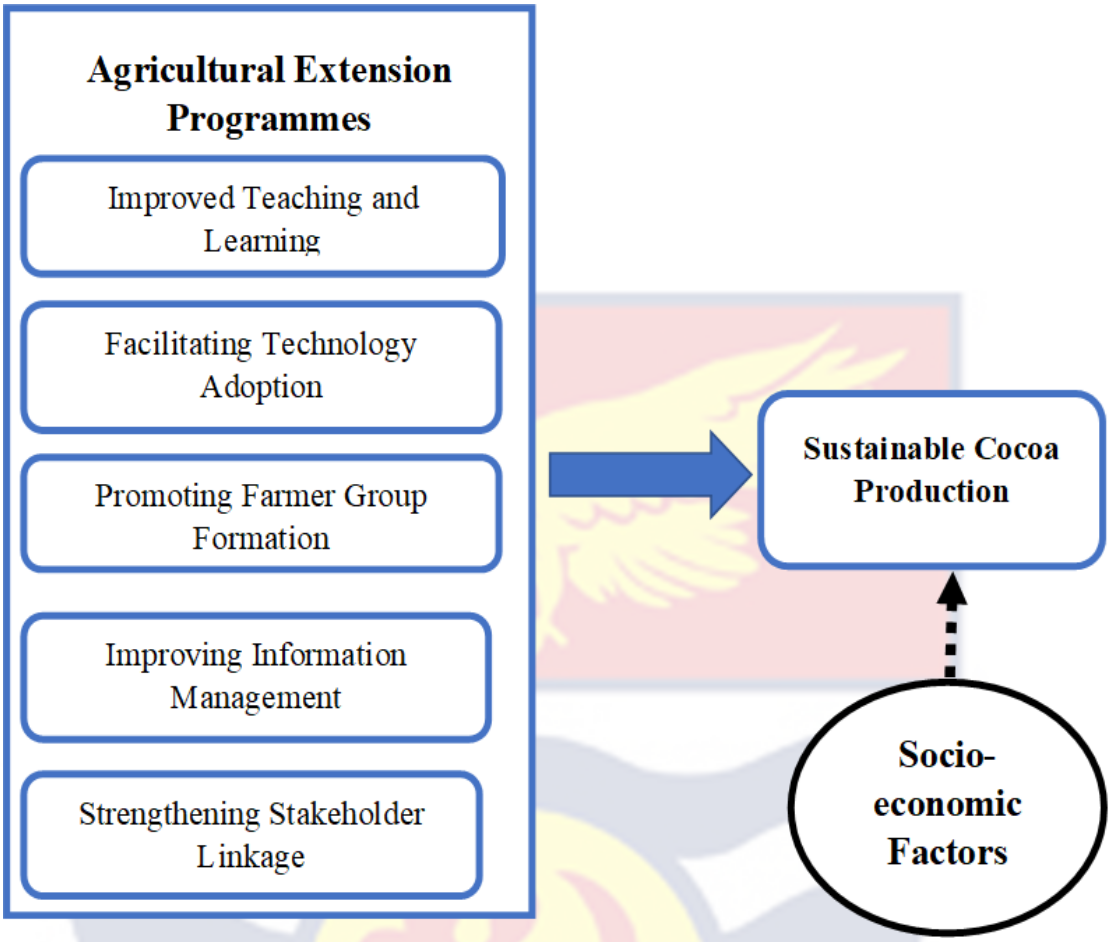

Figure 1: Cocoa Health and Extension Division's Programmes and Sustainable Cocoa Production in Ghana

Empirical Review

The backbone of developing economies is the vibrant and striving agriculture sector. Scholars have considered the antecedent of sustainable agricultural activities in both developed and developing countries. Factors such as agricultural extension activities and institutional support have been investigated as key pillars for the sustainable agriculture sector. To place the current study in the body of existing literature, this section of the study will review empirical investigations.

Agricultural Extension Activities and Sustainable Agricultural Production

The concept and direction of effective agricultural extension activities have evolved significantly over time, as examined by various researchers. Hlatshwayo and Worth (2019) notably explored and put forth a theoretical framework or model designed to enhance the visibility and accountability of agricultural extension activities to all stakeholders. Their work emphasized that agricultural extension should revolve around three primary objectives: ensuring food security, enhancing rural livelihoods, and improving natural resource management. Consequently, the overarching goal of extension initiatives should encompass noticeable shifts in attitudes, the adoption of innovative technologies, and an elevated quality of life. Progress in this regard can be measured by indicators such as farmers' well-being, encompassing factors like health, education, and housing. Many nations have realigned their extension efforts to align with these objectives.

For example, a comparative analysis was conducted between Nigeria and Gambia to assess the respective national extension policies and systems (Fatty, et al., 2021). The study found that both countries share a common purpose in their agricultural extension services. They commit resources to extension programs with the aim of enhancing agricultural profitability and increasing output volumes to improve the quality of life for their farming communities. The researchers reported a transformation in the decentralization and outsourcing of extension services in the public sector.

To realize the effectiveness of extension activities, it is imperative for countries to integrate essential components into the design of their extension programs. Dlamini and Worth (2016) stressed the importance of adopting participatory planning approaches in extension program development, as it enables all

stakeholders to provide valuable insights regarding the challenges and opportunities within their broader community. The researchers identified critical extension activities essential for agricultural sustainability, including improved teaching and learning methods, facilitating the adoption of technology, fostering the formation of farmer groups, enhancing information management, and strengthening stakeholder collaboration. Research has underscored the significant impact that agricultural extension programs have on sustainable agricultural production (Lamin, Ode, & Ahule, 2021; Akrofi-Atitianti et al., 2018).

Improved Teaching and Learning and Sustainable Agricultural Production

Improving the expertise of farmers through educational initiatives plays a crucial role in advancing agricultural production. Extension officers should employ a variety of teaching methods, including rallies, workshops, field training, field visits, and demonstrations, to assist farmers in acquiring the essential skills and knowledge required for agricultural practices. Elevating both the technological and pedagogical competencies of extension personnel enhances their ability to gather and manage agricultural data and offer services that cater to the needs of data users (Dlamini & Worth, 2016). Research has underscored the influence of effective teaching and learning on the sustainability of agricultural production. As an illustration, in their 2021 cross-sectional study on Gambia's horticultural crop production, Lamin, Ode, and Ahule observed 398 farmers and 10 extension officers. The findings disclosed that farmers acknowledged the existence of extension services within the country. Nonetheless, they noted that access to these services proved challenging due to the infrequency of visits by extension officers for training and other support.

Dlamini and Worth (2016) emphasized that for teaching and learning to contribute to agricultural sustainability, extension officers should adopt a

collaborative learning approach that fosters genuine partnerships with research institutions, fellow extension workers, funding agencies, and policymakers. Viewing farmers as active partners in the research and innovation process is likely to enhance their productivity. Gebrehiwot (2015) also investigated the impact of the Integrated Household Extension Program (IHEP) on the well-being of participating households. The study encompassed data collected from 730 farming households, utilizing a three-stage stratified random sampling method, with 361 in the program group and 369 in the control group. The research revealed that extension activities significantly improved household welfare by increasing farmers' income by approximately 10 percent. However, in terms of diversifying income sources among households, the program did not exhibit any significant impact. An additional observation from the study is that households with less diversified income sources tended to have higher overall incomes and specialized in crop farming. Consequently, this study posits that

H_1: Extension officers of the Cocoa Health and Extension Division applying diverse Teaching and learning methods in their services with farmers will have a significant impact on Sustainable Cocoa Production in Ghana

Facilitating Technology Adoption and Sustainable Agricultural Production

Research and development are imperative in the development of effective extension activities in the country. Extension officers have the responsibility to partner with research institutions to facilitate research and development to improve their training activities. Dlamini and Worth (2016) emphasized the necessity for active farmer involvement in the process of technological development that impacts their agricultural activities. Promoting the dissemination of well-founded agronomic practices resulting from research and encouraging farmers to embrace these practices is crucial for enhancing competitiveness and sustainability in agriculture. It is

imperative for extension officers to establish a strong connection between research, extension services, and farmers, thereby fostering the development and adoption of suitable technologies to boost agricultural productivity. Hlatshwayo and Worth (2019) also highlighted that the dissemination and adoption of improved agricultural technology and management practices have a long history, dating back thousands of years in various parts of the world, including China, Mesopotamia, Egypt, and the Americas. This underscores the vital role of extension officers in facilitating the development and adoption of technology in farming activities for sustainable agricultural production.

With regard to the influence of technology on agricultural sustainability, Donkor et al. (2016) conducted a study examining the impact of agricultural extension on the adoption of chemical fertilizers and their effects on rice productivity in Ghana, utilizing a multistage sampling technique with 470 farmers. The researchers discovered that access to extension services significantly promotes the adoption of chemical fertilizers among farmers and contributes to improved rice productivity in the country.

Lastly, Ehiakpor et al. (2016) conducted research on the degree of adoption and the factors influencing variations in adoption rates among cocoa farmers in the Prestea Huni-Valley district of Ghana. They collected cross-sectional data from a sample of 180 participants in eight randomly selected communities. The findings revealed that 92.78% of farmers had adopted pruning, while 21.11% had embraced hybrid seeds, and 18.89% had engaged in timber planting on their cocoa farms. Furthermore, adoption rates for controlling black pod diseases with fungicides, managing capsids with insecticides, applying fertilizer, and implementing land and water management stood at 72.22%, 98.89%, 55.56%, and 3.33%, respectively. The

processes have improved cocoa production within the area. Therefore, the third hypothesis reads

H_2: the extension officers of the Cocoa Health and Extension Division facilitating technology adoption among cocoa farmers will have a significant impact on Sustainable Cocoa Production in Ghana.

Promoting Farmer Group Formation and Sustainable Agricultural Production

Studies have reported the essence of a cooperative system in the farming community to ensure solidarity and productivity. For instance, Dlamini and Worth (2016) have proposed that the creation of farmer groups within a community can increase the chances of successfully implementing innovations on a broader scale, leading to collective outcomes and advantages. Through the pooling of their resources, these groups can effectively enhance their agricultural activities. Conversely, Anang et al. (2020) in Ghana reported different results. They examined the impact of agricultural extension services, specifically the establishment of farmer groups, on the adoption of improved rice varieties and farm income in northern Ghana. Anang and colleagues employed a multistage stratified random sampling approach to select rice farmers from the Kumbungu district in the Northern Region, as well as the Bolgatanga Municipal and Kassena-Nankana districts in the Upper East Region. Anang et al. discovered that extension services had a more substantial influence on the adoption of improved rice varieties among farmers in the Northern part of the country, while membership in a farmer group was negatively associated with the adoption of improved rice varieties and farm outcomes.

In contrast, Ehiakpor et al. (2016) reported different findings regarding the influence of farmer groups on adoption and productivity among cocoa farmers in the

Prestea Huni-Valley district of Ghana. The researchers conducted a random survey of 180 cocoa farm households from eight communities, using a well-structured questionnaire. They concluded that the potential increase in cocoa yield among farmers due to the adoption of cocoa farm management techniques was closely tied to their membership in a farmer-based organization (FBO). This observation aligns with the results presented by Danso-Abbeam et al. (2018). Drawing on cross-sectional data from 200 farm households in Ghana's Northern region, these researchers also demonstrated that farmers in the region could gain positive economic benefits from participating in agricultural extension programs offered by the Association of Church-based Development NGOs (ACDEP). They identified that the likelihood of farmers engaging in ACDEP extension programs was significantly influenced by the age of the household head, membership in a farmer-based organization, and the size of plots allocated to maize production (farm size). Consequently, this current study postulates the following hypotheses.

H_3: the assistance of the extension officers of the Cocoa Health and Extension Division in the formation of cooperative groups among cocoa farmers will have a significant impact on Sustainable Cocoa Production in Ghana.

Improving Information Management and Sustainable Agricultural Production

An informational resource is key in decision-making irrespective of the sector of operations. Access to relevant information provides a competitive advantage to organisations. According to Dlamini and Worth (2016) emphasized the critical role of information management as a pivotal resource in enhancing agricultural productivity for farmers. This underscores the necessity for agricultural extension officers to proactively implement policies that foster the unhindered exchange of information among all stakeholders in the agricultural industry, as accurate and timely

information aids farmers in making informed decisions and taking appropriate actions. Policymakers should prioritize ensuring the availability of communication infrastructure, particularly in rural areas, where the majority of cocoa growers are situated, to promote agricultural productivity (Dlamini & Worth, 2016).

In a study conducted in Gambia, researchers investigated agricultural extension services and post-harvest technology concerning horticultural crop produce for smallholder farmers. Their findings revealed that farmers often lack access to pertinent information from extension agents, leading to post-harvest losses (Lamin, Ode, & Ahule, 2021).

Danso-Abbeam et al. (2018) employed cross-sectional data collected from 200 farmer households in the Northern region of Ghana. Their research highlighted that access to agricultural credit facilities serves as an incentive for farmers to engage in extension programs, seeking additional information that can assist them in optimizing their yield and repaying the credit on schedule. Consequently, the current study asserts that

H_4: the extension officers of the Cocoa Health and Extension Division improving information management among cocoa farmers will have a significant impact on Sustainable Cocoa Production in Ghana.

Strengthening Stakeholder Linkage and Sustainable Cocoa Production

Within the agricultural sector especially in most developing countries, enhancing stakeholder engagement and linkages is essential for agricultural sustainability. Farmers depend on various stakeholders such as bankers. Non-governmental organisations, agricultural input supplies, and the government for farming activities. Connecting these stakeholders in a way that enables the

synchronization of their efforts has the potential to enhance the performance of the agricultural sector. Extension officers are well-positioned to harness and streamline the activities of all parties involved, reducing instances of contradictions, redundancies, and competition. Such issues often leave less affluent farmers perplexed, making it difficult for them to discern the most beneficial path forward (Dlamini & Worth, 2016). Numerous research studies have underscored the pivotal role played by stakeholders in promoting sustainable agricultural production. For example, Danso-Abbeam et al. (2018) utilized cross-sectional data collected from 200 farmer households in the Northern region of Ghana. Their findings indicated that access to agricultural credit facilities serves as a motivating factor for farmers to engage in extension programs, as these programs facilitate interactions with various institutional components such as credit officers and social groups. Anang et al. (2020) also observed that farmers participating in extension activities are more likely to utilize credit for their farming endeavors, with extension officers aiding in accessing these credit facilities. Finally, Danso-Abbeam et al. (2018) highlighted that institutional support and farm-specific variables significantly impact farmers' agricultural income. Thus, the study's hypothesis that... remains valid.

H_5: the extension officers of the Cocoa Health and Extension Division's ability to Strengthen stakeholder linkage for cocoa farmers will have a significant impact on Sustainable Cocoa Production in Ghana.

Socio-economic Factors, CHED Extension Activities, and Sustainable Cocoa Production

Studies have highlighted the role socioeconomic factors such as age, education, and civil status play in the decision-making of people, especially within the agricultural sector. In the study conducted by Lamin, Ode, and Ahule (2021), their

research focused on agricultural extension services and post-harvest technology in the context of horticultural crop production for smallholder farmers in the Kombo Central and North regions of the West Coast Region in The Gambia. Their investigation revealed that a significant number of farmers in this community possess limited literacy levels, which in turn affect their willingness to participate in extension activities aimed at improving farm management and post-harvest practices within horticultural production.

Likewise, Gebrehiwot (2015) explored the effects of the Integrated Household Extension Program (IHEP) on the well-being of participating households in Ethiopia. The research findings indicated that various socio-economic factors, such as gender and the age of the household head, play a role in influencing aspects like income, investment, and income diversification among farmers in the country. It is worth noting that the study disclosed that households led by males tend to have incomes that are 29 percentage points higher than those headed by females.

Ehiakpor et al. (2016) reported in their study in Ghana that the decisions of cocoa farmers to adopt farm management practices are influenced by factors like the marital status of the farmer, household size, educational attainment, membership in farmer-based organizations, and access to extension services. The researchers emphasized that farmers with larger household sizes are more likely to adopt a greater number of farm management practices compared to those with smaller household sizes.

A similar study was conducted by Owusu-Sekyere et al. (2021) among rice farmers in northern Ghana, examining how factors such as age, gender, years of schooling, household size, and farm size influence their decisions to participate in the

irrigation management transfer (IMT) scheme. The researchers demonstrated that education levels and access to extension activities have a positive impact on yields and net farm returns for both participants and non-participants of the IMT scheme. However, labour wages and fertilizer prices exhibited significant negative impacts on rice productivity and net farm returns.

The study by Danso-Abbeam et al. (2018) also highlighted the significant influence of socio-economic factors and farm-specific variables on farmers' farm income.

Moreover, Anang et al. (2020) found that concerning gender, male farmers are more likely to adopt improved crop varieties than their female counterparts, and the level of education among farmers has a greater impact on their adoption behaviours.

In conclusion, this study suggests that socioeconomic and demographic factors play a crucial role in shaping the decisions and practices of smallholder farmers in various regions, emphasizing the importance of tailored agricultural extension programs and support for sustainable agricultural practices.

$H_{6:}$ socio-economic variables of the farmers will influence the adoption of extension activities and Sustainable Cocoa Production in Ghana.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

The methodological procedures used to collect the data for the study are highlighted in this chapter. The research methodology, research location, and study participants—including the population, sample, and sampling technique—are covered in the first section. Additionally, covered in this section are methods for gathering data, ethical issues, data collection techniques, and data analysis.

Research Design and Approach

Scholars have presented various interpretations of research designs and methodologies. For instance, Bryman and Bell (2015) characterized the research approach as the overarching strategy employed by scholars to conceptualize and synthesize different facets of a study in order to address a research inquiry. According to Creswell (2014), a research design can be described as the specific methods, procedures, or techniques utilized by a researcher to collect and analyze data. In their work, Creswell and Creswell (2017) classified research into two primary categories: quantitative and qualitative research approaches.

In this study, the researcher has chosen to adopt a quantitative research approach to investigate the impact of the Cocoa Health and Extension Division's Programs on Sustainable Cocoa Production in Ghana. This approach was selected because the researcher aims to examine how extension services influence sustainable cocoa production in Ghana, with cocoa farms in the Ahafo-Ano District of the Ashanti Region serving as the study population. The researcher employed the cross-sectional survey design for data collection. As defined by Creswell and Creswell (2017), a cross-sectional survey is a data collection method in which a researcher

gathers information from a representative cross-section of the population of interest to better understand the phenomena. This survey method is well-suited for descriptive, explanatory, and exploratory purposes, as noted by Creswell (2014). Therefore, the decision to use the cross-sectional quantitative survey design enabled the collection of data from a large number of cocoa farmers, facilitating the generalizability of the results (Creswell & Creswell, 2017).

Research Setting

Creswell and Creswell (2017) define the term "research setting" as the specific location or geographical area where data is collected for a study. The research setting can encompass various scales, such as a community, district, region, or even an entire country, depending on the scope of the study. In the present study, a community-based research approach was employed, and the study sample was drawn from farming communities within the Ahafo Ano North Municipal area in Ghana.

Data collection took place in the Ahafo Ano North Municipal, one of the 260 Metropolitan, Municipal, and District Assemblies (MMDAs) in Ghana. This district is part of the 43 MMDAs in the Ashanti Region and was created in 1988 by the Parliament of Ghana through Legislative Instrument (LI 1402). In March 2018, it was elevated to municipal status (L.I. 2264). The Municipal comprises 39 electoral areas with one town council and six Area Councils.

Ahafo Ano North Municipal is located in the northwestern part of the Ashanti Region, between latitude 60 47'N and 70 02'N and longitude 2026'W and 20 04'W, with a total landmass of 593.7km2. Tapa serves as the district's capital, approximately 70km away from Kumasi. The district includes prominent towns like Manfo, Akwasiase, Mabang, Anyinasuso, Asuhyiae, and Betiako. It shares boundaries with

districts such as Tano North Municipal, Tano South Municipal, Atwima Mponua District, Asutifi South District, and Ahafo Ano South East District (Ghana Statistical Service, 2014).

According to the 2010 Population and Housing Census, the population of the Ahafo Ano North Municipality stands at 94,285, with 47,956 males and 46,329 females. Using the district's population growth rate of 2.96 percent, the current estimated population is 115,644, with males comprising about 50.9 percent and females 49.1 percent (Republic of Ghana Composite Budget for 2019-2022, 2019).

The Ministry of Food and Agriculture reports that approximately 23,284 farmers are located in the Ahafo-Ano North Municipality as of September 21, 2023. However, the specific number of farmers engaged in cocoa farming is not specified. Agriculture is the predominant economic activity in the district, employing roughly 78.7 percent of the labor force. Farming in the district is primarily subsistence (90%), and farmers cultivate food crops such as plantain, cocoyam, cassava, and various vegetables, along with cash crops like cocoa, oil palm, and citrus. Cocoa is the primary cash crop, followed by oil palm and coffee. The district experiences bi-modal rainfall patterns, enabling farmers to engage in farming activities twice a year (Republic of Ghana Composite Budget for 2019-2022, 2019).

The Population of the Study

Scholars have proposed various interpretations of the research population. For example, Gravetter and Forano (2018) characterized a research population as a distinct group of individuals who share common attributes relevant to a researcher's focus, thus making them eligible for inclusion in the study. Consequently, a population typically exhibits shared characteristics, such as age, gender, occupation,

marital status, and working conditions that are pertinent to the research query (Uprichard & Dawney, 2019).

The primary objective of this research is to explore the sustainable cocoa production practices within the agricultural community of the Ahafo-Ano North Municipality. According to data from the 2010 Population and Housing Census, the municipality had a total population of 94,285, with 47,956 males and 46,329 females. Agriculture serves as the dominant economic activity in this region, engaging approximately 78.7 percent of the labor force. As per the Ministry of Food and Agriculture, there are approximately 23,284 farmers in the Ahafo-Ano North Municipality (mofa.gov.gh, September 21, 2023). However, the exact number of cocoa farmers was not specified. Farming practices in the district are primarily subsistence (90%), with farmers cultivating crops like plantains, cocoyams, cassava, as well as other vegetables and cash crops like cocoa, oil palm, and citrus. Cocoa stands as the primary cash crop in the municipality, followed by oil palm and coffee. The region experiences bi-modal rainfall, allowing farmers to engage in agricultural activities twice a year (Republic of Ghana Composite Budget for 2019-2022, 2019). Therefore, in line with the goals of this research, cocoa farmers in the visited communities within the district constituted the accessible population from which the sample was selected.

Sample and Sample Size

Numerous definitions exist for both the terms "sample" and "sample size" in research. For instance, Patten and Newhart (2018) have defined a sample as a portion of a population selected for a research study, with the expectation that this sample shares common characteristics with the entire population. Concerning sample size, as

stated by Creswell and Creswell (2017), it represents a subset of the accessible population that is chosen for study.

Researchers have identified two primary reasons for opting to use a sample in research rather than examining the entire population. In social science research, studying the entire population is either unfeasible or impractical, as noted by Creswell and Creswell (2017). Furthermore, it is possible to select a portion of the population for study and then draw inferences about the entire population of interest, as highlighted by Zhang, Wang, and Zhao (2017). Therefore, it is crucial for researchers to determine an appropriate sample size that can accurately represent the population. This step is essential to avoid the issues of under-sampling and over-sampling, which can result in resource wastage and the inability to generate meaningful results, as emphasized by Nardi (2018). Consequently, the determination of an appropriate sample size holds significant importance, particularly in the context of survey research. The researcher used Sloven's formula to determine the sample size and the calculation is found below:

$n = N / (1+Ne^2)$

n = sample size

N = the population size of Ahafo-Ano North Municipality (23,284)

e = a margin of error (0.05)

The population size is 94,285 and the margin of error is 0.05.

n = 23,284 / (1 + 23,284 (0.05^2))

(0.05^2) = 0.0025

n = 23,284 / (1 + 23,284 (0.0025))

n = 23,284 / (1 + 58.21)

n = 23,284 / 59.21

n ≈ 393.244, Rounding up to the nearest whole number, the sample size required is approximately 393.

In this study, the researcher utilized Slovin's formula to determine the sample size, resulting in the distribution of survey questions to 399 cocoa farmers within the Ahafo-Ano Cocoa District. However, despite multiple follow-ups with the farmers, only 220 questionnaires were collected. After excluding questionnaires with errors and incompleteness, only 200 questionnaires were deemed suitable for data analysis, accounting for 50.12% of the original sample.

Sampling Technique

Gravetter and Forzano (2018) defined the concept of sampling technique as the methodology employed by researchers to choose a subset of a population for their study. The primary rationale behind utilizing sampling techniques is to ensure equitable representation from a larger population. Two primary categories of sampling techniques were identified by Creswell and Creswell (2017): probability sampling and non-probability sampling methods. Probability sampling is described as a method in which every member of the population has an equal chance of being selected for the study, giving researchers limited control over the selection of participants (Patten & Newhart, 2017). Some examples of probability sampling methods include simple random sampling, systematic sampling, cluster sampling, and stratified sampling. In contrast, non-probability sampling refers to procedures where population members do not have equal chances of selection (Gravetter & Forzano, 2018). Non-probability sampling methods encompass techniques such as purposive

sampling, convenience sampling, snowballing, and quota sampling, among others (Patten & Newhart, 2017).

In this study, the researcher opted for a non-probability sampling technique, specifically the convenience sampling method, to select cocoa farmers as respondents. As per Patten and Newhart (2017), the flexibility inherent in the convenience sampling method allows researchers to choose willing and available participants for their study. Consequently, the cocoa farmers were chosen based on their availability and voluntary participation. To ensure that the research aligns with its stated objectives, the researcher established inclusion and exclusion criteria. For instance, only cocoa farm owners within the Ahafo-Ano Cocoa District were included, while those who did not meet the criteria were excluded. According to Etikan, Musa, and Alkassim (2016), "the convenience sampling technique is applicable to both qualitative and quantitative studies, although it is predominantly used in quantitative research, while purposive sampling is typically employed in qualitative studies" (p.3).

Research Instrument

The process of gathering data encompasses a variety of approaches, which include utilizing survey questionnaires, observation, and conducting interviews to obtain information from study participants. In the specific context of a cross-sectional survey design, the primary instrument for data collection is the questionnaire. This questionnaire serves as the principal means for gathering data from research participants. According to Nardi (2018), questionnaires occupy a prominent position among research tools due to their practicality. They allow for the efficient collection of substantial volumes of data from a large sample in a short timeframe, all while being cost-effective. In this study, data was obtained using existing questionnaires that were adjusted to align with the specific conditions in Ghana. These

questionnaires were organized into different sections, each of which was designed to evaluate distinct aspects related to attitudes and the usage of cashless payment systems. The following sections outline the components of the questionnaire:

Part I: Evaluation of Agricultural Extension Services, with the following variables and items: Teaching and Learning Methods (5 items), Facilitating the Adoption of Technology (6 items), Formation of Farm Groups (4 items), Information Management (5 items), and Linkage with Stakeholders (4 items). Respondents were required to provide their responses on a 5-point Likert scale, where 1= Strongly Disagree, 2 = Disagree, 3 = Somehow, 4 = Agree, and 5 = Strongly Agree.

Part II: Examination of Challenges Faced by Cocoa Farmers, involving the following items: Financial constraints, Aging cocoa trees, Fluctuating prices of farm inputs, Bush fire, Aging cocoa farmers, Pest, insects, and diseases, Drought and high temperatures, Poor access to inputs, Tampering with cocoa scales calibrations, Illegal logging, Illegal Mining (Galamsey), and Lack of extension services. Respondents were asked to select all the challenges that hindered their cocoa farming activities.

Part III: Assessment of Sustainable Cocoa Production through income generated from the sale of cocoa beans during the last cocoa season. Cocoa farmers were requested to specify the amount of money they received in Ghana Cedi.

Part IV: The Demographic Information section of the questionnaire sought details such as gender, age, and educational level.

Procedures for Data Collection

The study began by obtaining approval from the School of Graduate Studies and Research at Christian Service University College. Afterward, a preliminary investigation was conducted to validate the questionnaire's clarity and its applicability

to the farming community prior to embarking on the primary data gathering phase. Subsequent to the pilot study, it was confirmed that the measurement tools employed in the research were indeed functional, instilling the researcher with the necessary assurance to proceed with the primary data collection.

Ethical Consideration

In accordance with the guidelines provided by Nardi (2018), it is advisable for researchers to adhere to established ethical standards and principles when engaging in research activities. These ethical principles play a crucial role in protecting participants, maintaining research integrity, establishing trust with them, preventing any form of misconduct or inappropriate behavior that could harm their organizations or institutions, and addressing novel and intricate issues, as emphasized by Creswell and Creswell (2017).

In light of this guidance, the researcher in the present study took necessary precautions to strictly follow the ethical principles governing the involvement of human participants in research. The researcher, with the assistance of local community informants, sought permission from each cocoa farmer before initiating any data collection. During the process of obtaining consent, the study's objectives and scope were explicitly communicated to the farmers. The researcher also placed a strong emphasis on maintaining strict confidentiality and anonymity, implementing measures to safeguard the identities of the participants throughout the data management process. This was carried out to ensure that no data could be directly linked to any specific individual, and only those who willingly consented were provided with the questionnaire for completion.

Data Analysis

The researcher utilized Microsoft Excel and Statistical Package for Social Sciences (SPSS) software version 20 to process and analyse the collected data. Out of the 399 distributed questionnaires, 200 were accepted and organized in Excel before being input into the SPSS software, constituting a response rate of 50.13%. Initial analysis involved generating descriptive statistics, including frequency and percentage tables. The researcher then rigorously examined all prerequisites for multivariate analysis before employing inferential statistics to assess the research hypotheses. To investigate the impact of Agricultural Extension Programmes on Sustainable Cocoa Production within the country, a Hierarchical Regression Analysis was conducted. Additional information regarding this analysis is provided in the presentation of findings in chapter four.

CHAPTER FOUR

RESULT AND DISCUSSION

Introduction

In this chapter, we share the outcomes of our research, which we've organized into two main segments. The initial part delves into an exploration of the demographic characteristics of the survey respondents and their evaluations of the Cocoa Health and Extension Division's Programs as well as Sustainable Cocoa Production. The subsequent section examines the correlation between the influence of the Cocoa Health and Extension Division's Programs and Sustainable Cocoa Production.

Demographic Characteristics

Within this section, we provide a comprehensive overview of the 200 survey participants utilized in our research. We showcase their background demographic information in Tables 1 and 2. Table 1 illustrates that a majority of the participants, specifically 103 individuals (constituting 51.5% of the total), are male, while the remaining 97 (48.50%) are female. Among the 200 participants, 124 (62%) disclosed that they engage in a secondary occupation in addition to farming, whereas 76 (38%) responded in the negative.

Table 1:Demographic Characteristics of the Respondents

Characteristics	Categories	Frequency	Percentage
Gender	Male	103	(51.5%)
	Female	97	(48.5)
Secondary Occupation	Yes	124	(62.00%)
	No	76	(38.00%)

Source: Field data (2023)

To Assess Extension Programmes Cocoa Health and Extension Division offers Cocoa Farmers in the Ahafo-Ano Cocoa District

This part presents the results of the participant's assessment of the Agricultural Extension Services of CHED in the Ahafo-Ano District in the Ashanti Region. Table 2 presents the participants' assessment of the Teaching and Learning Methods that CHED extensive officers used in assisting cocoa farmers from Ahafo Ano Cocoa District. Five items were used to analyze how effective the teaching and learning methods are.

Under item 1, "*Extension officers use rallies in the teaching methods" the* majority of the respondents 59 (29.50%) and 77 (38.50%) agreed and strongly agreed whiles only 17 participants disagreed. This demonstrates that farmers are happy with the teaching and learning methods of the extension officers. For item 2: "*Extension officers use field training as part of their teaching methods"* 56 participants representing (28.00%) selected agreed and 77 accounting for (38.50%) chose strongly agreed. Only 17 representing (8.50%) selected strongly disagree. The result revealed that the majority of the respondents agreed to the use of field training employed by extension officers of CHED. Item 3 examined *"Extension officers use workshops as part of their teaching methods"*. 59 respondents accounting for (29.50%) expressed agreed and 74 participants chose strongly agreed which represents (37.00%) while 20 respondents selected strongly disagreed. As regards item 4: *"Extension officers use field visits as part of their teaching methods"* 113 respondents out of the 200 selected agreed and strongly agreed while 49 participants chose strongly disagreed and disagreed. The responses highlight that most of the farmers expressed their agreement with the statement. Finally, the result for item 5: *"Extension officers use demonstrations as part of their teaching methods"* revealed that 115 participants

expressed that they agreed and strongly agreed with the statements while 56 demonstrated strong disagreement and disagreement.

The findings support previous studies such as Lamin, Ode, and Ahule, (2021). The researchers found that to assist farmers in acquiring the necessary skills and knowledge in agricultural operations, extension officers combine a number of extended techniques of teaching, including rallies, seminars, field training, field visits, and demonstrations. The competence of extension personnel to gather and manage agricultural data and provide services to fulfill data user needs is facilitated by their capacity to have their technological and pedagogical abilities improved. (Dlamini & Worth, 2016).

Table 2. Respondent Assessment of Teaching and Learning Methods

Teaching and Learning Methods	Strongly Disagreed	Disagreed	Neither	Agreed	Strongly Agreed
1. Extension officers use rallies in the teaching methods	7 (3.50%)	12 (6.00%)	45 (22.50%)	59 (29.50%)	77 (38.50%)
2. Extension officers use field training as part of their teaching methods	17 (8.50%)	18 (9.500%)	32 (16.00%)	56 (28.00%)	77 (38.50%)
3. Extension officers use workshops as part of their teaching methods	20 (10.50%)	21 (10.50%)	26 (13.00%)	59 (29.50%)	74 (37.00%)
4. Extension officers use field visits as part of their teaching methods	14 (7.00%)	35 (17.50%)	38 (19.00%)	41 (20.50%)	72 (36.00%)
5. Extension officers use demonstrations as part of their teaching methods	23 (11.50%)	26 (13.00%)	36 (18.00%)	42 (21.00%)	73 (36.50%)

Source: Field data (2023)

Table 3 shows the assessment of the participants on the extension officer's help in Facilitating the Adoption of Technology among the farmers in Ahafo Ano Cocoa District. A total of Five items were used to assess the phenomenon. Item 1, "*Extension officers help us to adopt new transplanting technology for cocoa seedlings" the* majority of the respondents 104 (52.00%) and 75 (38%) selected strongly agreed and agreed respectively while only 21 (10%) participants disagreed. For item 2: "*Extension officers help us to adopt innovative ways to prepare our lands for cocoa planting"* 133 participants representing (66.50%) selected strongly agreed and 32 (16%) chose agreed. Only 35 respondents selected neither and disagreed. Item 3 examined *"Extension officers help us to adopt innovative ways of pruning our cocoa trees"*. 59 respondents accounting for (29.50%) expressed agreed and 74 participants chose strongly agreed which represents (37.00%) while 20 respondents selected strongly disagreed. As regards item 4: *"Extension officers help us to adopt new technology for cocoa pest and disease control"* 96 (48%) respondents selected strongly agreed, 42 (21%) chose agreed while 62 participants chose strongly disagreed and disagreed. The responses highlight that most of the farmers expressed their agreement with the statement. For item 5: *"Extension officers help us to adopt innovative ways for cocoa fertilizer and pesticide applications"* revealed that 77 (38%) participants expressed strongly agreed, 56 (28%) selected agreed and 56 demonstrated strong disagreement and disagreement. Finally, the result for item 6: *"Extension officers help us to adopt innovative ways for the identification of disease-infested trees"* revealed that 132 (66%) participants strongly agreed, while 68 (34 %) demonstrated agreement. Table 3 presents the result of facilitating the adoption of technology.

Table 3: Facilitating the Adoption of Technology

Facilitating the Adoption of Technology	Strongly Disagreed	Disagreed	Neither	Agreed	Strongly Agreed
1. Extension officers help us to adopt new transplanting technology for cocoa seedlings	_	21 (10.00%)	_	75 (38.00%)	104 (52.00%)
2. Extension officers help us to adopt innovative ways to prepare our lands for cocoa planting		17 (8.50%)	18 (9.500%)	32 (16.00%)	133 (66.50%)
3. Extension officers help us to adopt innovative ways of pruning our cocoa trees	20 (10.50%)	21 (10.50%)	26 (13.00%)	59 (29.50%)	74 (37.00%)
4. Extension officers help us to adopt new technology for cocoa pest and disease control	0 (0%)	26 (13.00%)	36 (18.00%)	42 (21.00%)	96 (48.00%)
5. Extension officers help us to adopt innovative ways for cocoa fertilizer and pesticide applications	_	35 (18.00%)	32 (16.00%)	56 (28.00%)	77 (38.50%)
6. Extension officers help us to adopt innovative ways for the identification of disease-infested trees	_	_	_	68 (44.00%)	132 (66.00%)

Source: Field data (2023)

Table 4 presents the participants' assessment of the support the extension officers give to farmers in the Formation of Farm Group in assisting cocoa farmers from Ahafo Ano Cocoa District. Five items were used to analyze how effective the formation of farm groups was. Under item 1, "*Extension officers helped us in the formation of our cocoa cooperative union" the* majority of the respondents 141 agreed and strongly agreed to the help extension officers offered them in the

formation of their cooperative unions. However, 33 participants disagreed. This demonstrates that extension officers play an active role in the formation of farm-based associations among cocoa. For item 2: "*1. Extension officers help our cocoa cooperative union to solve our farming problems"* 32 participants representing (16.00%) selected agreed and 133 accounting for (66.50%) chose strongly agreed. Only 17 (8.50%) selected disagreed with no one selected strongly disagreed. The outcome shows that the majority of the respondents agreed to the use that CHED extension officers to assist them in solving cocoa farm challenges. Item 3 examined *"Extension officers take an active part in the activities of our cocoa cooperative union"*. 42 respondents accounting for (21.00%) expressed agreed and 73 participants chose strongly agreed which represents (36.50%) while 23 respondents selected strongly disagreed. Finally, As regards item 4: *"Extension officers guide our cooperative union to pull resources together (natural resources, physical resources, human resources, and information resources.)."* 133 respondents selected agreed and strongly agreed while 67 participants chose neither agreed nor disagreed. The responses highlight that most of the farmers expressed their agreement with the statement.

Table 4: Formation of Farm Group

Formation of Farm Group	Strongly Disagreed	Disagreed	Neither	Agreed	Strongly Agreed
1. Extension officers helped us in the formation of our cocoa cooperative union	10 (0%)	23 (11.50%)	36 (18.00%)	26 (13.00%)	115 (57.50%)
2. Extension officers help our cocoa cooperative union to solve our farming problems	0 (0%)	17 (8.50%)	18 (9.500%)	32 (16.00%)	133 (66.50%)
3. Extension officers take an active part in the activities of our cocoa cooperative union	23 (11.50%)	36 (18.00%)	26 (13.00%)	42 (21.00%)	73 (36.50%)
4. Extension officers guide our cooperative union to pull resources together (natural resources, physical resources, human resources, and information resources.).	0 (10.50%)	0 (0%)	67 (34.00%)	59 (29.50%)	74 (37.00%)

Source: Field data (2023)

Table 5 shows the assessment of the participants on the extension officer's help in Information Management and dissemination among the farmers in Ahafo Ano Cocoa District. A total of Five items were used to examine the management of information. Item 1, "*Extension officers provide us with timely information about cocoa issues" the* majority of the respondents 141 (57.50%) and 36 (18.00%) strongly agreed and agreed whiles only 23 (11.50) participants neither agreed nor disagreed. This demonstrates that CHED extension officers help in information dissemination and management among farmers. For item 2: "*We totally depend on our extension officers for correct information about new farming practices"* 109 participants representing (54.50%) selected strongly agreed and 56 accounting for (28.50%) chose

agreed. Only 17 representing (8.50%) selected neither agree nor disagree. The result revealed that the majority of the farmers rely on extension officers for vital farming information. Item 3 examined *"We have the necessary communication infrastructure in our community to receive important information concerning cocoa farming"*. 59 respondents accounting for (29.50%) expressed agreed and 95 participants chose strongly agreed which represents (47.00%) while 26 respondents selected neither agree nor disagree. As regards item 4: *"The timely and correct information I receive from extension officers helps me make an informed decision about my cocoa farm."* 113 (56.50) respondents out of the 200 selected strongly agreed; 38 (19.00%) agreed while 35 participants selected disagreed. The responses highlight that most of the farmers receive timely and correct information from extension officers. Finally, the result for item 5: *"It is easy for me to get the necessary cocoa farming information"* revealed that 174 participants expressed that they agreed and strongly agreed with the statements while 26 demonstrated neither agree nor disagree.

This research aligns with a previous investigation carried out in various regions of Africa. For instance, in Gambia, a study was conducted to assess the provision of agricultural extension services and post-harvest technology for smallholder horticultural crop producers. The findings revealed that smallholder farmers in Gambia face challenges in accessing pertinent information from extension agents, leading to increased post-harvest losses (Lamin, Ode, & Ahule, 2021). Similarly, Danso-Abbeam et al. (2018) utilized cross-sectional data collected from 200 farmer households in the Northern region of Ghana. Their research indicated that access to agricultural credit facilities acts as an incentive for farmers to engage in extension programs, seeking additional information to enhance their crop yields and ensure timely loan repayment.

Table 5: Information Management

Information Management	Strongly Disagreed	Disagreed	Neither	Agreed	Strongly Agreed
1. Extension officers provide us with timely information about cocoa issues		0 (0%)	23 (11.50%)	36 (18.00%)	141 (57.50%)
2. We totally depend on our extension officers for correct information about new farming practices	0 (0%)	17 (8.50%)	18 (9.50%)	56 (28.00%)	109 (54.50%)
3. We have the necessary communication infrastructure in our community to receive important information concerning cocoa farming	20 (10.50%)	0 (0%)	26 (13.00%)	59 (29.50%)	95 (47.50%)
4. The timely and correct information I receive from extension officers helps me make an informed decision about my cocoa farm.	_	35 (17.50%)	_	38 (19.00%)	113 (56.50%)
5. It is easy for me to get the necessary cocoa farming information	_	_	26 (13.00%)	_	174 (87.00%)

Source: Field data (2023)

Table 6 shows the participants' assessment of the support the extension officers give to farmers in Linkage with them to other Stakeholders from Ahafo Ano Cocoa District. Five items were used to analyze how effective the formation of farm groups was. Under item 1, "*Extension officers help us get access to farm inputs for the Ghana Cocoa Board and Government" the* majority of the respondents 174 strongly agreed and 26 agreed to the help extension officers offer them in accessing

farm inputs from the Ghana Cocoa Board. For item 2: "*Extension officers help us to get access to cocoa inputs from agricultural suppliers"* 72 participants representing (36.00%) selected strongly agreed, 76 accounting for (38.00%) chose agreed, and 52 representing (26.00%) selected neither agree nor disagree. The outcome shows that the majority of the respondents agreed to the use that CHED extension officers to assist them in getting input from suppliers. Item 3 examined *"Extension officers help us get financial support from banks, microfinance institutions, etc"*. 78 respondents accounting for (39.00%) expressed agreed and 73 participants chose strongly agreed which represents (36.50%) while 23 and 26 respondents selected strongly disagreed, and neither agree nor disagree respectfully. As regards item 4: *"Extension officers help us to get farming support from NGOs and other organisations."* 74 respondents representing (37.00%) selected strongly agreed, 59 participants accounting for (29.50%) selected agree, and 46 participants chose neither agreed nor disagreed. The responses highlight that most of the farmers expressed their agreement with the statement.

The current study provides credence to similar studies conducted in Ghana. For instance, Danso-Abbeam et al. (2018) reported that access to agricultural credit facilities serves as an encouragement for farmers to participate in the extension programme because, through the extension officers, it becomes easier for farmers to deal with various institutional variables such as credit officers and social groups. Anang et al. (2020) also reported that farmers who participate in extension activities used credit in farming compared to those without extension access.

Table 6: Linkage with Stakeholders

Linkage with Stakeholders	Strongly Disagreed	Disagreed	Neither	Agreed	Strongly Agreed
1. Extension officers help us get access to farm inputs for the Ghana Cocoa Board and Government	_	_	_	26 (13.00%)	174 (87.00%)
2. Extension officers help us get access to cocoa inputs from agricultural suppliers	_	_	52 (26.00%)	76 (38.00%)	72 (36.00%)
3. Extension officers help us get financial support from banks, microfinance institutions, etc.	_	23 (11.50%)	26 (13.00%)	78 (39.00%)	73 (36.50%)
4. Extension officers help us to get farming support from NGOs and other organisations	_	21 (10.50%)	46 (23.50%)	59 (29.50%)	74 (37.00%)

Source: Field data (2023)

To Assess the Challenges Cocoa Farmers Face in their Farming Activities in the Ahafo-Ano Cocoa District

Table 7 presents the result of research objective three which is stated, "to examine challenges facing cocoa farmers in Ahafo Ano Cocoa District in the Ashanti Region". The data shows the majority of the participants identify financial constraints as the major challenge they face; followed by aging cocoa trees, and fluctuating prices of farm input. However, challenges such as illegal logging, illegal Mining (Galamsey), and lack of extension services received the lowest percentage. This study supports the findings of previous studies. For instance, Dlamini and Worth (2016) also discovered that price fluctuations are a major factor farmers encounter. This makes it difficult for farmers to plan the cost of their farm inputs. Hlatshwayo and Worth (2019) also reported that changing weather, financial constraints, and high cost

of farm input put much burden on farmers in countries such as China, Mesopotamia, Egypt, and even America.

Table 7: Challenges Facing Cocoa Farmers

Challenges	Percentages
1. Financial constraints	139 (69.5)
2. Aging cocoa trees	126 (63%)
3. Fluctuating prices of farm inputs	125 (62.5)
4. Bush fire	124 (62%)
5. Aging cocoa farmers	123 (61.5)
6. Pest, insects, and diseases	104 (52%)
7. Drought and high temperatures	80 (40%)
8. Poor access to inputs	75 (37%)
9. Calibrations on the cocoa scales are tampered with	74 (37%)
10. Illegal logging	61(30.50%)
11. Illegal Mining (Galamsey)	50 (25%)
12. Lack of extension services	30 (15%)

Source: Field data (2023)

To Assess the Impact of Extension Programmes of the Cocoa Health and Extension Division on Sustainable Cocoa Production in the Ahafo-Ano Cocoa District

Preliminary Analyses

Before the estimation of the influence of CHED extension services on sustainable cocoa production in Ghana and hypothesis testing, preliminary analyses such as the reliability of the scale, distribution of the data, and mean scores and standard deviations were conducted. The results are provided in Tables 8 – 9.

Reliability Levels of the Scale

The Cocoa Extension Activities were measured with the following five dimensions – Teaching and Learning Methods (5 items), Facilitating the Adoption of Technology (6 items), Formation of Farm Group (4 items), Information Management (5 items), and Linkage with Stakeholders (4 items). I item was used to measure sustainable cocoa production in Ghana. All five Cocoa Extension Activities scale was analyzed for their reliability using the Cronbach alpha (α). According to Bryman and Bell (2015), reliability analyses are conducted to test the ability of the scales to yield consistent scores to prove that the scales are suited for scientific research. Researchers have demonstrated that the Cronbach alpha should be more than 0.70 to consider the scale reliable (Tabachnick & Fidell, 2019). The results in Table 8 warrant that the scale is reliable to achieve its purpose. Table 8 presents the Reliability Test (Cronbach alpha (α)).

Table 8: Reliability Test (Cronbach alpha (α))

	No. of items	Cronbach alpha (α)
Cocoa Extension Activities		
Teaching and Learning Methods	4	.78
Facilitating the Adoption of Technology	6	.85
Formation of Farm Group	4	.79
Information Management	5	.87
Linkage with Stakeholders	4	.82
Sustainable Cocoa Production (sales from cocoa)	**1**	-

Source: Field data (2023)

Distribution of Data

Data distribution is one of the key assumptions in conducting the Ordinary Least Square test. The distribution of data was conducted using tools such as values of

skewness and kurtosis. Researchers have argued that data are judged as normally distributed when the values of skewness range between +1.00 and -1.00 and the values of Kurtosis range between +2.00 and -2.00 (Tabachnick & Fidell, 2019). Table 9 presents the results of the data distribution analysis. The results in Table 9 show that skewness values ranged between -0.23 and 0.62 and the kurtosis values ranged between 0.24 and 0.79. Based on the criteria set by Tabachnick and Fidell (2019) the values indicate that the scores were normally distributed with no outliers. Table 9 presents the Skewness and Kurtosis values of variables.

Table 9: Skewness and Kurtosis values of variables

	Skewness	Kurtosis
Cocoa Extension Activities		
Teaching and Learning Methods	-.56	.79
Facilitating the Adoption of Technology	-.23	.61
Format ion of Farm Group	-.42	-.56
Information Management	.62	.42
Linkage with Stakeholders	-.23	.55
Sustainable Cocoa Production (sales from cocoa)	-45	-.24

Source: Field data (2023)

Descriptive Statistics

After assessing the reliability levels and distribution of the data, the descriptive statistics of scores were estimated. The minimum scores, maximum scores, mean scores, and standard deviation on each of the variables are provided in Table 10.

Table 10. Descriptive Statistics

	N	Min	Max	Mean	Std. Deviation
How much did you get from selling your Cocoa beans in 2022?	200	3000	54400	12992.00	12378.541
Teaching and Learning Methods	200	4.00	5.00	4.5600	.30856
Facilitating the Adoption of Technology	200	3.67	5.00	4.4267	.41130
Formation of Farm Group	200	3.25	5.00	4.4000	.50000
Information Management	200	3.20	4.80	4.3440	.39799
Linkage with Stakeholders	200	2.50	5.00	4.1600	.51478

Source: Field data (2023)

Correlation Matrix of the Study Variables

The researcher conducted a correlation matrix using the Person r to assess the relationship between the variables based on the suggestion of (Bryman & Bell, 2015). Table 11 presents the summary of the results. The table revealed that sustainable cocoa production has a significant negative relationship with the Teaching and Learning Method ($r = -.453$, $p < .001$).

However, sustainable cocoa production recorded a significant positive association with the rest of the items – Facilitating the Adoption of Technology, Formation of Farm Groups, Information Management, Linkage with Stakeholders, Experience, and Age. Table 11 presents the summary of the results.

Table 11 Correlation Matrix of the Study Variables

	1	2	3	4	5	6	7	8
Cocoa Sustainability (Income from Cocoa Sales)	1							
Teaching and Learning Method	-.453**	1						
Facilitating the Adoption of Technology	.512***	.321	1					
Formation of Farm Group	.421***	-.261*	.211**	1				
Information Management	.571**	-.289**	.022	.180*	1			
Linkage with Stakeholders	.842**	-.034	-.362**	-.018	.366**	1		
Experience	.320***	-.087	.280*	.195*	.218**	-.016	1	
Age	.314*	-.046	.259*	.279*	.211	-.033	.242**	1

** Significant at p <.05; ** significant at p <.01; *** significant at p <.00*

Testing of Hypothesis

Before testing the hypotheses, the researcher took the advice of Tabachnick and Fidell (2007) to test key assumptions that need to be met such as the assumptions of multicollinearity and normality. In order to determine multicollinearity, the researcher employed tolerance and the variance inflation factor (VIF), as the normalcy result is already presented in Table 9. According to the criteria of Pallant (2010) and Tabachnick & Fidell (2007), the Tolerance values ranged from.355 to.972 and the VIF values from 1.231 to 3.121, respectively, indicating no multicollinearity.

The researcher used a hierarchical multiple regression analysis with the help of SPSS version 20 to test five Hypotheses in terms of the influence of CHED extension services on cocoa sustainability in Ghana. The demographic characteristics were controlled to ascertain the actual relationship between the phenomena. According to Pallant (2010), controlled demographic characteristics help the researcher avoid any noise that may influence the outcome of the analysis.

Two steps hierarchical multiple regression model was conducted by controlling variables like age, experience, and gender) in the model step 1. In step 2, CHED extension services – Teaching and Learning Method, Facilitating the Adoption of Technology, Formation of Farm Group, Information Management, and Linkage with Stakeholders, entered into the model. Table 12 presents the summary of the model result.

As the data in Table 12 has revealed, the overall model was found to be significant ($F = 24.266$, $p < .001$) and accounted for 24.60% ($R^2 = .246$) variance of sustainable cocoa production. In step 1, the control variables have an impact on cocoa production ($F = 1.333$, $p = .264$) without any statistical significance.

However, the model of step 2 revealed a statistical significance, the five CHED extension activities – Teaching and Learning Method, Facilitating the Adoption of Technology, Formation of Farm Group, Information Management, and Linkage with Stakeholders, predicted cocoa production sustainability ($\Delta F = 23.914$, $p < .001$), explaining 24.10% variance in sustainable cocoa production ($\Delta R^2 = .241$).

Out of the five extension activities, four recorded statistical significance – Teaching and Learning Method, Facilitating the Adoption of Technology, Formation of Farm Group, and Linkage with Stakeholders. This means that a unit increase in Teaching and Learning Methods reduces sustainable cocoa production by 14.7% ($\beta = -.147$, $t = -3.379$, $p < .001$). In terms of Facilitating the Adoption of Technology, the data shows that a unit increase improves sustainable cocoa production by 12.3% ($\beta = .123$, $t = 3.249$, $p < .05$). The result of Formation of Farm Group shows that a unit increase positively influences sustainable cocoa production 30.2% ($\beta = .302$, $t = 5.342$, $p < .001$). In addition, a unit increase in Linkage with Stakeholders enhances sustainable cocoa production by 39.2% ($\beta = .392$, $t = 6.022$, $p < .001$).

The findings corroborate the conclusions of prior research conducted by Dlamini and Worth in 2016. It was also observed by the researchers that extension officers hold a crucial role in coordinating the efforts of various stakeholders to prevent confusion, redundancy, and competition among them, ultimately benefiting impoverished farmers by providing clear guidance. Hlatshwayo and Worth (2019) emphasized that the utilization of advanced agricultural techniques and management practices has a long history spanning multiple regions globally, including China, Mesopotamia, Egypt, and America. This underscores the vital role of extension officers in promoting technological development and its implementation in farming practices for sustainable agricultural production.

In the context of technology's impact on agricultural sustainability, Donkor et al. (2016) conducted a study on the influence of agricultural extension services on the adoption of chemical fertilizers and their subsequent effects on rice productivity in Ghana. Employing a multistage sampling approach with 470 farmers, their findings revealed that access to extension services significantly encourages farmers to adopt chemical fertilizers, thereby enhancing rice productivity in the country. Danso-Abbeam et al. (2018) also emphasized the critical role of stakeholders in ensuring sustainable agricultural production in Ghana. However, it's noteworthy that Information Management, one of the extension activities, was not found to predict sustainable cocoa production, indicating support for four out of five hypotheses.

Table 12 Hierarchical Regression Analysis for CHED Extension Activities and Sustainable Cocoa Production in Ghana

Model	B	SE	Beta (β)	T	P
Age	.118	.205	.039	.585	.653
Experience	.089	.285	.035	.296	.675
Male	1.060	1.604	.023	.845	.446
Teaching and Learning Method	-.566	.185	-.147	-3.879	.000
Facilitating the Adoption of Technology	.564	.102	.123	3.249	.003
Formation of Farm Group	.633	.256	.302	5.341	.000
Information Management	.270	.351	.045	1.235	.282
Linkage with Stakeholders	.417	.227	.392	6.022	.000

Model 1: $R = .189$; $R^2 = .036$; $\Delta R^2 = .036$; Adjusted $R^2 = .009$; $F (3, 196) = 1.333$; $p = .264$;

Model 2: $R = .525$; $R^2 = .276$; Adjusted $R^2 = .246$; $\Delta R^2 = .241$; $\Delta F (5, 194) = 23.914$, $p < .001$

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATION

Introduction

The Chapter presents the summary, conclusion, and recommendation. It is opened with a discussion of the summary, then proceeds to the conclusion and recommendations.

Summary of the Study

The study set out to investigate the impact of the Cocoa Health and Extension Division's Programmes on Sustainable Cocoa Production in the Ahafo Ano North Municipality. Survey questionnaires were distributed to cocoa farmers in the Municipality. The data shows that the majority of the respondents were male while female accounts for the minority. In terms of secondary jobs, most of the participants indicated YES.

a. To Assess Extension Programmes Cocoa Health and Extension Division Offers Cocoa farmers in the Ahafo-Ano Cocoa District

Five variables – Teaching and Learning Methods, Facilitating the Adoption of Technology, Formation of Farm Group, Information Management, and Linkage with Stakeholders were used to assess the Agricultural Extension Services of CHED. In terms of the Teaching and Learning Methods employed by the cocoa extension officers, the respondent expressed that the officers' pedagogy is very helpful to them. They further expressed their agreement that the cocoa extension officers help them facilitate the Adoption of Technology for their farming activities. The cocoa farmers indicated that through the help of the extension officers, they can form associations to champion their welfare. They also depend on the extension officer to gain access to information that is essential to their farming activities. Finally, the extension officers

connect them to other Stakeholders who provide support to their farming activities. This demonstrates that the respondents expressed a great level of agreement with all the extension programmes of CHED.

b. To Assess the Challenges Cocoa Farmers face in their Farming Activities in the Ahafo-Ano Cocoa District

Furthermore, the cocoa farmers expressed that the most pressing challenge they face is financial constraints; followed by aging cocoa trees, and fluctuating prices of farm input. On the other hand, challenges such as illegal logging, illegal Mining (Galamsey), and lack of extension services received the lowest percentage.

c. To Assess the Impact of Extension Programmes of the Cocoa Health and Extension Division on Sustainable Cocoa Production in the Ahafo-Ano Cocoa District

In terms of the impact of Agricultural Extension Services of CHED on Sustainable Cocoa Production, the results revealed that the demographic characteristics of the respondents do not influence Sustainable Cocoa Production as the data show in hierarchical regression Step 1. In terms of Step 2 of the regression model, the results show that out of the five extension activities, four recorded statistical significance – Teaching and Learning Method, Facilitating the Adoption of Technology, Formation of Farm Group, and Linkage with Stakeholders. On the contrary, Information Management as one of the extension activities did not predict sustainable cocoa production. This demonstrates that four out of five hypotheses were supported.

Conclusion

Based on the summary of findings, the following conclusions were drawn for the study.

First, the demographic characteristics revealed that the majority of the participants were male cocoa farmers who engaged in other forms of businesses to complement their cocoa farming in the Municipality. This supports the fact that farming has been regarded as a male-dominated job in Ghana, especially cash crop farming.

Second, the cocoa farmers expressed their level of agreement on all the Five variables – Teaching and Learning Methods, Facilitating the Adoption of Technology, Formation of Farm Group, Information Management, and Linkage with Stakeholders were used to assess the Agricultural Extension Services of CHED. This demonstrates that extension officers are providing essential services to cocoa farmers in the country.

Third, the majority of the cocoa farmers in the Ahafo-Ano Cocoa District expressed that financial constraint hampers their farming activities as well as aging cocoa trees, and fluctuating prices of farm input.

Fourth, the demographic characteristics of the respondents do not influence Sustainable Cocoa Production in Ghana. However, four out of the five extension activities – Teaching and Learning Method, Facilitating the Adoption of Technology, Formation of Farm Groups, and Linkage with Stakeholders influence Sustainable Cocoa Production in Ghana but Information Management as one of the extension activities did not predict sustainable cocoa production.

Recommendation

The researcher put forward the following recommendations based on the conclusions and findings. The recommendations were divided into two – policymakers and future researchers.

The policymakers especially the Ghana Cocoa Board should provide all the necessary support to Cocoa Health and Extension Division (CHED) for them to continue extending the extension services to all cocoa farmers in the country.

The policy-makers should provide necessary interventions to address the challenges of cocoa farmers in the rural areas of the country. Interventions such as soft loan facilities, free replacement of aging cocoa trees, and price stability mechanisms to check the fluctuations of farm input.

The management of CHED should examine the teaching and learning methods used by their extension officers to meet the needs of cocoa farmers in the country.

Finally, the researcher recommends the following for future researchers: Researchers should expand the current population to include other cocoa farmers from other districts and municipalities to get a fair representation of the findings.

In addition, future researchers should employ other research methods such as mixed-method to study the phenomenon to get a holistic understanding of phenomenon. Last but not least, future researchers should replicate the current study to validate the findings.

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APPENDIX

Dear Sir/Madam,

You have been selected to fill out the survey questionnaire regarding this research, "**COCOA HEALTH AND EXTENSION DIVISION'S PROGRAMMES AND SUSTAINABLE COCOA PRODUCTION IN GHANA: A CASE OF AHAFO ANO COCOA DISTRICT."** Your free and honest response to questions will be appreciated. The researcher of the project assures you that your responses to the questions will be solely used for the research purpose of the said project. The confidentiality of your responses is assured, and you have the right to opt out of the said project at any point in time. Thank you.

PART I: Please, select the number that corresponds to how the statement applies to you.

1= Strongly Disagreed 2= Disagreed 3= Neither 4= Agreed 5= Strongly Agreed

6. I consider extension officers' use of rallies in teaching me helpful	1	2	3	4	5
7. I consider extension officers' use of field training in teaching me helpful	1	2	3	4	5
8. I consider extension officers' use of workshops in teaching me helpful	1	2	3	4	5
9. I consider extension officers' use of field visits in guiding me helpful	1	2	3	4	5
10. I consider extension officers' use of demonstrations in guiding me helpful	1	2	3	4	5
11. Extension officers help me adopt new transplanting technology for cocoa seedlings	1	2	3	4	5
12. Extension officers introduced me to innovative ways to prepare our lands for cocoa planting	1	2	3	4	5
13. Extension officers guide me to adopting innovative ways of pruning our cocoa trees	1	2	3	4	5
14. Extension officers guide me to adopting new technology for cocoa pest and disease control	1	2	3	4	5
15. Extension officers guide me to adopt innovative ways for cocoa fertilizer and pesticide applications	1	2	3	4	5
16. Extension officers assist me in adopting innovative ways to identify disease-infested cocoa trees	1	2	3	4	5
17. Extension officers facilitated the formation of my cocoa cooperative union	1	2	3	4	5
18. Extension officers guide my cocoa cooperative union members to solve our farming problems	1	2	3	4	5

19. Extension officers take an active part in the activities of my cocoa cooperative union	1	2	3	4	5
20. Extension officers assist my cooperative union in pulling resources together (natural resources, physical resources, human resources, and information resources.).	1	2	3	4	5
21. Extension officers provide me with timely information about cocoa issues	1	2	3	4	5
22. I depend on extension officers for correct information about new cocoa farming practices	1	2	3	4	5
23. My community has the necessary communication infrastructure to receive important information concerning cocoa farming practices	1	2	3	4	5
24. The timely and correct information I receive from extension officers helps me make an informed decision about my cocoa farm.	1	2	3	4	5
25. It is easy for me to get the necessary cocoa farming information	1	2	3	4	5
26. Extension officers help me get access to farm inputs for the Ghana Cocoa Board and Government	1	2	3	4	5
27. Extension officers assist me in getting access to cocoa inputs from agricultural suppliers	1	2	3	4	5
28. Extension officers assist me in getting financial support from banks, microfinance institutions, etc.	1	2	3	4	5
29. Extension officers help me to get farming support from NGOs and other institution	1	2	3	4	5

PART II: Please, check (/) all challenges as applied to your farming activities

Institutional factors	
1. Bush fire	
2. Drought and high temperatures	
3. Illegal Mining (Galamsey)	
4. Aging cocoa trees	
5. Aging cocoa farmers	
6. Poor access to inputs	
7. Illegal logging	
8. Fluctuating prices of farm inputs	
9. Pest, insects, and diseases	
10. Lack of extension services	
11. Financial constraints	
12. Calibrations on the cocoa scales are tampered with	

PART III: COCOA SUSTAINABILITY

This part assesses your cocoa output. Please, check or write the details as applied to you.

How much did you get from selling your Cocoa beans in 2022? _____

PART IV: This part assesses your demographic profile. Please, check or write the details as applied to you.

A. Socio-economic Factors

Your Age

How old are you? _____

Gender

Male [ ] Female [ ]

Secondary Occupation

Do you have other business aside from cocoa farm Yes [ ] No [ ]