**PRODUCTIVITY INTERVENTION AND
SMALLHOLDER FARMERS: THE CASE OF
GHANA'S COCOA ABRABOPA PROGRAM**

by

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B.Sc., Central University College, 2003

A THESIS

Submitted in partial fulfillment of the requirements

for the degree

MASTER OF AGRIBUSINESS

Department of Agricultural Economics

College of Agriculture

KANSAS STATE UNIVERSITY

Manhattan, Kansas

2014

Approved by:

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ABSTRACT

Despite the dependence of more than three-quarters of a million households

depending on cocoa for their living in Ghana, the production segment of the cocoa industry

is fraught with significant challenges manifesting as low farm productivity. Various

intervention programs to help farmers improve productivity at the farm level have been

used over the past few decades. One of such programs is the Cocoa Abrabopa Program

(CAA), which uses an integrated approach where farmers are supplied inputs made up of

fertilizer, pesticides and fungicides as well as provided training and extension support

services. The inputs are provided on credit and the producers repay the cost of these inputs

upon selling their crop.

This study sought to assess the results of the CAA in enhancing the net profits of its

members over time. It used survey data collected over five years from members of the

CAA program. The study used an econometric model to evaluate the demographic and

production characteristics of CAA members on their net profits. The results show that male

members in the CAA program had higher net profits that their female counterparts, about

GHS 237.32 more. For every year increase in the member's age, the net income increased

by GHS 6.46, which was statistically significant at the 10 percent level. The crux of the

study – the effectiveness of the CAA program in enhancing performance – was supported

by the results. Participants who were two years in the program posted GHS 591.13 more

net profit than those who were in their first year. Those who were three year and four or

more years posted respectively GHS 1,211.04 and GHS 18,752.29 than those in the first

year. All these were statistically significant at the 1 percent level. Thus, the CAA program

is producing what it is expected to produce – enhancing the net profits of its members and doing so in higher levels with the duration of membership. The study also found that having a bank account produced a higher effect on net profits than being male, posting GHS 296.13 more net profit than not having a bank account. The econometric model specified and estimated was significant and the variability in all the independent variables in the model explained about 46 percent of the variability in net profits.

The study recommends that the CAA program incorporates helping all its members open bank accounts as part of its offerings. It also recommends working with policymakers and community leaders across its operational areas to encourage investments in the education of females and elimination of the tenural rights discrimination that frequently confronts females in agriculture. It also recommends that an increased effort be made to expand membership of the CAA program to all cocoa producers in Western South because of the significant benefit of the yield effect of the region on net profit of CAA members in the region.

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CHAPTER I: INTRODUCTION

1.1 Global Cocoa Production

Cocoa serves as an important cash crop around the world: a cash crop for developing countries and a key import commodity for some developed countries. Cocoa is travels along a global supply chain crossing countries and continents, the complex production process involves numerous parties including farmers, buyers, transport companies, processors, chocolatiers and distributors. The production at the farm level is often a delicate process as the crop is susceptible to various conditions and practices which if not monitored and managed has an effect on output. Unlike larger industrialized agribusinesses, the vast majority of Cocoa still comes from small holder farmers-90 percent of global output is from small holder farmers with an average land holding of 2-5 Ha. It is worth noting that Cocoa production over the years has increased in absolute terms from 3.66 million metric tons in 2007-2008 to 3.98metric tons in 2011-2012. As seen in table 1.0. According to World Cocoa Foundation, Africa remains a principal producer of the crop, it contributed about 73 percent of global production in 2011-2012 production years. The key producing countries in this region include Ghana, Cote D'Ivoire and Nigeria.

Table 1.1: Global Cocoa Production 2007-2012

	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	07/08-1/12
	Total	Total	Total	Total	Total	% Change
Total Production (000 tonnes)	3,667.00	3,507.00	3,569.00	4,197.00	3,987.00	0.09
% Change	0.07	(0.04)	0.02	0.18	(0.05)	
Total Africa	2,603.00	2,451.00	2,428.00	3,076.00	28,801.00	0.08
% Change	0.10	(0.06)	(0.01)	0.27	(0.09)	
Cameroun	188.00	210.00	205.00	230.00	220.00	0.17
Cote D'Ivoire	1,431.00	1,234.00	1,184.00	1,668.00	1,400.00	(0.02)
Ghana	730.00	730.00	740.00	860.00	870.00	0.19
Nigeria	200.00	210.00	230.00	240.00	230.00	0.15
Other Africa	55.00	67.00	69.00	78.00	81.00	0.47
Total Asia and Oceania	614.00	596.00	642.00	563.00	623.00	1.47
% Change	(0.03)	(0.03)	0.08	(0.12)	0.11	
Indonesia	500.00	490.00	530.00	450.00	500.00	-
Malaysia	32.00	25.00	20.00	18.00	18.00	(0.44)
Other Asia	82.00	81.00	92.00	95.00	105.00	0.28
Total Americas	450.00	459.00	499.00	558.00	563.00	0.25
% Change	0.11	0.02	0.09	0.12	0.01	
Brazil	170.00	155.00	159.00	197.00	185.00	0.09
Ecuador	115.00	130.00	150.00	160.00	170.00	0.48
Other Latin America	165.00	174.00	189.00	201.00	208.00	0.26
Source: ICCO, USDA, Reuters,LMC Report February 2012						

1.2 Importance of Cocoa in Ghana

Ghana is an agricultural nation with more than half of its population engaged in many agricultural production activities, including cocoa production. Cocoa is an important cash crop and various administrations in Ghana, including the British Colonial Government, used it as a source of public revenue. The crop, introduced into Ghana in the 19th Century, has grown to become its second leading foreign exchange earner, worth about 30 percent of all export revenue and accounting for about 57 percent of total agricultural export value. The cocoa sector directly and indirectly employs about 2 million people, and constitutes a large chunk of Ghana's GDP; 8.1 percent in 2006 and 10 percent in 2010. These indicators paint cocoa's contribution to the development of Ghana's economy.

The crop is produced by smallholder farmers with an average land area of about 3 hectares. Cocoa production by these farmers offers jobs, livelihoods and incomes to some 800,000 farmers and their families. By virtue of its impact on the rural economy in Ghana, cocoa is, indeed, leading the way in alleviating poverty in areas where the crop is grown.

1.3 The Changing Fortunes of Cocoa Production in Ghana

Cocoa production in Ghana over the decades has gone through four distinct phases:

(1) The introduction and exponential growth phase in 1888-1937;

(2) The stagnation phase followed by a brief but rapid growth stage after Ghana's independence (1938-1964);

(3) Near collapse phase between in 1965 and 1982; and

(4) The recovery and expansion phase, which started in 1983 and is still going on.

The figure shows how the various phases affected its global market share.

Figure 1.1: Global Market Share by Cocoa Producing Countries
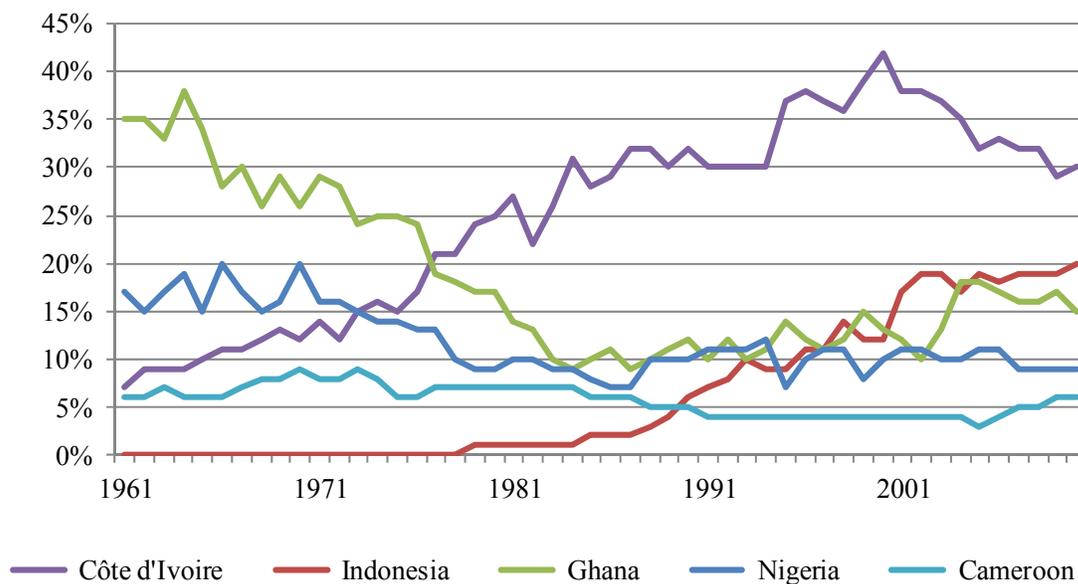
The collapse of world cocoa prices in 1965 triggered a downturn of cocoa production in Ghana leading to a decline in production volumes. Real producer prices dropped significantly

through the 1960s because of inflation fueled by the government printing money to compensate for lost revenue from cocoa. The introduction of an exchange rate policy which led to the heavy overvaluation of the Ghana cedi only made things worse.

By 1983, the market exchange rates were nearly 44 times the official rate (Kolavalli and Vigneri 2011). These outcomes created a distortion of in the economy between 1970s and the early 1980s. It was also estimated that as much as 20 percent of Ghana's cocoa harvest was smuggled into Cote D'Ivoire (Bulir 2002). Within the same period, an aging tree stock and continued spread of pests and diseases resulted in unattractiveness of cocoa as an investment. Farmers found sales prices barely covered their cost of production and therefore turned to food production (Amanor 2005), this was against a backdrop of increasing supply of cocoa from new producers such as Malaysia and Indonesia as well as an expansion of production in neighboring Cote D'Ivoire. In addition to these issues, Ghana also lost its cheap source of labor from Burkina Faso and Cote D'Ivoire, the migrants had become reluctant to work in the cocoa growing communities because cocoa farms had become less productive. They were attracted to neighboring Ivorian regions where there were policies that granted land access to migrants' favorable terms. Ghana's cocoa production volumes dipped to a low of 159,000 tons in 1982/83, a mere 17 percent of the total world volume, down from the 36 percent it enjoyed in 1964/65 (Shashi and Vigneri 2011). The cocoa industry at point was in distress and drastic measures had to be undertaken to mitigate the situation.

1.4 Government Sector Intervention

In 1983, the Ghana Government commenced the implementation of the Economic Recovery Program. The activities included special program to revive the cocoa sector tagged as the cocoa rehabilitation project. Key policy changes implemented included an increase in producer price of cocoa paid to cocoa farmers in Ghana relative to that paid to cocoa farmers in neighboring

countries to discourage smuggling of the crop into these countries. Part of the rehabilitation plan was to compensate farmers for removing trees infected with swollen shoot disease and planting new ones, the swollen shoot disease had become a problem to the industry. In place of the infected trees, new early maturing varieties were introduced by the Cocoa Research Institute (CRIG), a substantial number of farms in the country benefitted from this program, the outcome was a boost in production during the 1995/96 season. Average farm productivity was 210-404 kilograms per hectare. As a result of government's mass spraying of cocoa farms and the introduction of hi-tech subsidy package resulting in growth in production (Vigneri and Santos 2008). The industry recovered from down turn as presented in Figure 1.1.

1.5 NGO and Government Support for Cocoa Farmers in Last Decade

Over past decades, some non-governmental organizations (NGOs) have provided varied services to address the challenges faced by cocoa farmers in Ghana. These initiatives to help address challenges within the sector, especially because they affect the livelihood of some rural people. Most of these programs sought to improve production technology and to provide farmers with skills and tools to operate their farms as businesses. Their objectives were to improve yield, incomes and livelihoods. Specifically, the activities of these organizations have allowed the beneficiary farmers to access inputs on a timely basis, provided training to deal with knowledge gaps in cocoa production and contribute to solving productivity-related issues faced by farmers.

In more recent times, some organizations have worked with cocoa farmers in building their capacity to improve productivity at the farm level. An example is the programs implemented by organizations such as the Sustainable Tree Crop Program and the Cocoa Abrabopa Association. Other organizations have dealt with advocacy activities for farmers and other key players within the sector. Barry Callebaut, a cocoa processing company with operations in Ghana, in collaboration with International Cocoa Initiative, is implementing child labor sensitization

programs and other education and community based activities in Ghana. This program seeks to ensure the use of children on cocoa plantations is prevented or brought to its minimal threshold. Also, Care International is partnering with Cadbury Ghana Limited to make the cocoa supply chain within some 500 cocoa growing communities more sustainable. The goal is to attract younger people into the industry, especially in the cultivation of the crop. This is implemented by providing training in production practices while embedding them in organized value chains to make it more profitable. It is envisaged that the program will help modernize farming practices and introduce labor-saving devices, helping to improve efficiency in the industry and encourage farming as an occupation.

The World Cocoa Foundation (WCF), in partnership with the Bill and Melinda Gates Foundation, is implementing a program that seeks to increase farmer incomes through the establishment of business service centers, farmer business schools and cocoa marketing tools in a program tagged "cocoa livelihoods program". In addition, Sustainable Tree Crop Program (STCP) has an intervention program geared towards addressing challenges faced by cocoa farmers. Its objective is to increase farmer productivity in a sustainable environment through farmer training, organizing co-operatives and conducting research. Last but not the least in the intervention programs to support cocoa farmers in Ghana is the Cocoa Abrabopa Program (CAA). This program uses an integrated approach that combines credit, input supply and business skills as well as agronomic training programs to improve productivity at the farm level and improve incomes and livelihood of beneficiary cocoa farmers involved.

The above programs and interventions by the various organizations clearly indicate that the performance of cocoa farmers is critical to Ghana position as a major a global producer of cocoa. Furthermore, these programs highlights the importance of getting the younger generations engaged

in cocoa production, using efficient methods of production and the right input mix. Finally, improving the welfare of farmers, generally, not just engaged in cocoa production but in alleviating poverty.

1.6 Cocoa Abrabopa Association Value Proposition in Cocoa Production in Ghana

Riding on the back of the high technology program introduced by the government of Ghana, Wienco, a cocoa input dealer, commercialized the program by supporting the establishment of the Cocoa Abrabopa Association. The Cocoa Abrabopa Association is a farmer based organization (FBO) working with some cocoa farmers with the objective to improve the incomes and livelihoods of cocoa farmers in all cocoa growing regions in Ghana. Using an integrated approach, beneficiary cocoa farmers are provided with a package made up of Special Cocoa fertilizer, fungicides, pesticides training on good agronomic practices in cocoa, business skills, group dynamics training and provide with basic records keeping tools. Typically inputs are supplied in April and repayment commences in November the same year. Cocoa farmers join a group in their community or form groups to become eligible. The program is operational in all seven cocoa growing zones in Ghana.

1.6.1 Benefits to Cocoa Farmers

Cocoa farmers who become duly registered are expected to benefit from the following:

1. Enhanced knowledge in practical cocoa agronomy and post-harvest management

2. Reduction cocoa pod losses to known cocoa diseases

3. Free access to training in essential non agronomic skills-e.g., numerate skills, negotiation skills, communication and marketing skills.

4. Income improvements resulting from higher yields and better quality beans

5. A better social and economic status

1.6.2 Benefits for the Economy and Cocoa Sector

Benefits that will accrue to the economy and the cocoa sector are as follows:

1. An identifiable body of people who can be targeted for measurable social services in relation to poverty reduction

2. A reliable source of high quality cocoa beans - meeting international standards leading to improved foreign exchange

3. Reduction in environmental degradation as a result of controlled and monitored use of recommended agricultural inputs as well as a reduction in deforestation as a result of higher yields per unit area of land

4. Positive image of cocoa production as an attractive and viable source of income and wealth creation among the youth

1.7 Research Problem and Question

Even though cocoa continues to be an important part of Ghana's economy, various interventions by government regimes, private sector players and non-governmental organizations, the fortunes of the cocoa farmers have not fully been realized. People residing in the cocoa and other farming zones and regions in the country are known to be among the poorest in Ghana although the income potential exists for cocoa farmers. Pests and diseases, poor agronomic practices, such including poor farm maintenance and improper use of inputs plague cocoa farmers. Finally cocoa farmer attitude towards their farms as businesses is poor and, therefore, they do not make any significant investments, leading to low yields and incomes thereby contributing to poor living conditions.

The various intervention programs including the government's free spraying to reduce the incidence of pest and disease and providing fertilizer at subsidized rates have not made the difference that was anticipated. The role played by NGO's and private sector companies,

including Cocoa Abrabopa Association, in providing inputs, skills development and professionalization of cocoa farmer groups aim to address the challenges in a different manner.

The question this project is seeking to address is this: How successful has the Abrabopa Program been in enhancing the economic wellbeing of its members? This leads to numerous sub-questions, including:

- Does the Cocoa Abrabopa Program offer superior benefits to men vis-a-vis women?
- Does the number of years a farmer practicing Abrabopa on the same piece of land improve yields and eventually incomes?
- Does the region of farming affect and changes a farmer's experience?
- Finally, does age of the farmer affect the performance of the Cocoa Abrabopa farmer?

These questions contribute to a critical assessment of the Cocoa Abrabopa Program's performance over time and in terms of its importance as an innovative solution to the problem of smallholder cocoa farmers in Ghana.

1.8 Research Objectives

The specific objectives are as follows:

i.   Determine the key socioeconomic characteristics of cocoa Abrabopa participants

ii. Evaluate the principal characteristics of Abrabopa participants that affect their performance

iii. Develop recommendations that may be implemented to enhance the wellbeing of producers through CAA program

1.9 Scope of Study

The study seeks to cover all the ecological zones in Ghana. Cocoa is grown in seven ecological zones in Ghana. Each location is characterized by different soil types, volume of rainfall, incidence of pest and diseases. It is therefore important for any study to take into consideration these factors. The locations to be considered in this study include the Ashanti, Brong

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Ahafo, Central, Eastern, Volta, Western North and Western South Regions; these are known

Cocoa Abrabopa operational areas as well as the cocoa growing regions in Ghana. The study will

also take into consideration the gender, age of farmer, number of years farmers have been in the

Association with their related hectares under cultivation and the corresponding yields. Finally, the

profitability of the various categories of these farmers will be examined.

1.10 Thesis Outline

This thesis is structured in four chapters. Chapter 1 has presented the background of the

study including a brief discussion of the situation in Ghana, the Objectives, and the scope of the

study. The research problem and the objectives have also been discussed. Chapter 2 provides an

overview of related literature and a discussion of the hypotheses and the estimation of the model

used. Chapter 3 provides a description of the data used in the study and the models used. Finally,

Chapter 4 presents the results, analysis, conclusion and recommendations from the study.

CHAPTER II: LITERATURE REVIEW

2.1 Technical Inefficiency in Cocoa Production in Ghana

Cocoa yields in Ghana are well below international averages, suggesting reral potential for productivity growth. (FAO, 2005; ICCO, 2007)   Gray and Binam et al (2008) reported that Ghana appears to be the least efficient in cocoa production compared to other cocoa producing countries in the African sub-region. In addition, there is an observation that growth in Ghana's cocoa sector has been achieved by increasing area cultivated rather than improving yield (MOFA, 2006; COCOBOD, 2007).

Danso-Abbeam et al. (2010) analysis found that the key determinants that contribute to technical inefficiency include farmer's age, gender, marital status, years in school, years of cocoa growing experience, household size and participation in government's CODAPEC program. Kyei, Foli and Ankoh (2011) analyzed the factors that affected technical efficiency of cocoa farmers in the Offinso district of the Ashanti Region. The study analyzed the basic determinants of technical efficiency as well as socio-economic variables using primary data collected through a questionnaire. This study estimated the stochastic production frontier function and the inefficiency determinants based on socioeconomic variables of individual farmers. Input factors studied include labor, quantity of fertilizer and pesticides applied, use of modern equipment, age of trees and farm sizes. Of the above, labor and age of trees were not statistically significant. The estimate of inefficiency component showed that with the exception of the age of farmers, most of the specific characteristics were not significant. Kyei et al. (2011) recommended that using and properly adjusting production factors such as labor, capital and age of trees would lead to increased output. In addition, inefficiency would decrease if variables such as educational level and farming experience increased.

Nyariki (2011) also investigated smallholder production efficiency in Kenya. The study applied Data Envelopment Analysis (DEA) to farm-level seasonal panel data. The estimated indexes indicate high levels of inefficiency for all farm sizes, seasons, and adopters and non-adopters of modern 'farming technologies. A further comparison of various farming practices shows that the use of modern inputs and livestock-based capital significantly improve farmer's performance. In addition, level of education, gender, and market access and off-farm capital are key influencing factors. The study, thus, concluded that policies aimed at improving rural infrastructure as well as assuring farmers of income through improved livelihood opportunities, could improve farm-level efficiency.

2.2 Determinants of Farmer Incomes

Makorere and Mbiha (2012) assessed the factors that determine farmers' income in Muheza district, Tanzania using 152 respondents who produce oranges in in the region. They were selected through a simple random sampling technique and interviewed through administered questionnaire, stepwise multiple regressions were used to analyze the data. The study reported that the factors influencing net cash income are farm size, number of orange trees, prices received, and yield per hectare. These variables accounted for about 52% of the total variance in income of farmers within a given year.

2.3 Determinants of Farmer Profitability

Onoja, Deedam and Achike (2012) assessed the profitability of cocoa farms in Nigeria's largest cocoa producing state and assessed their profitability determinants. A stratified random sampling method was used to select 125 farmers from five local government areas of Ondo State who were interviewed using a structured questionnaire. Data were analyzed and descriptive statistics, budgetary analysis and ordinary least squares (OLS) multiple regression model results were reported. The results showed that cocoa production is profitable. The major determinants

reported by the study were labor, capital, seedlings planted and household size. It was recommended that cocoa farming be promoted to create jobs/reduce poverty with financial support from microfinance Institutions and agricultural agencies. Also, the study recommended that farmers need to be trained on most efficient ways of production to guarantee sustainable production of cocoa.

Onoja and Herbert (2012) investigated the level of profitability of rice and the factors influencing rice profitability in Kogi State in Nigeria. Results indicated that rice farming in the state was profitable, with an average farm posting a profit of at least US$788.30 annually. Rice profitability in the area was largely influenced by farmers' socio-economic attributes and production factors including farmers' age, farming experience and years of formal education. The resource inputs that significantly influenced rice profitability in the area of study was volume of farm credit accessed, value of fertilizer applied and water/irrigation expenses. Consequently, it was recommended that policies that will make farm credit available at affordable rates to the farmers, promotion of rice as a means of livelihood, enhanced access of farmers to educational facilities and removal of subsidy/government interference in fertilizer which increases the market price of fertilizer in the country be put in place in Nigeria. The study also recommended that Government should invest more in irrigation facilities to reduce the cost of fertilizer production in the study area.

2.4 Importance of Credit

According to Vigneri (2008), cocoa is characterized by a production technology requiring the use of working capital mainly to hire labor for clearing and weeding the land, and to purchase the chemicals needed to spray cocoa farms to control of pests and diseases. Lundstedt and Pärssinen (2009) concluded that farmers are, generally, liquidity constrained and need credit in order to maintain or expand production. Gockowaski (2007) highlighted that "The lack of

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effective rural credit institutions in West Africa is a brake on intensification." Farmers facing cash liquidity constraints and no access to credit markets may not achieve an efficient outcome. Nwama (2000) stated that insufficient capital and a lack of access to credit can limit the adoption and efficient deployment of agricultural technologies and engaging in other farm income earning activities.

2.5 Adoption of Cocoa Production Technologies

Aneani et al. (2012) concluded that adoption of the cocoa production technologies recommended to the cocoa farmers by the Cocoa Research Institute of Ghana (CRIG) had been low, leading to yield and production levels below potential. The World Bank/FAO (1992) also stated that the main practice of cocoa farmers in Ghana tends to be a 'stepwise' mode of adoption of the innovations. In the same publication, it was reported that fertilizer adoption decision is affected by access to credit and number of cocoa farms owned by the farmer. In addition, the decision on weeding frequency is also influenced by gender of the farmer because it is labor intensive. The adoption of cocoa variety is affected by age of the farmer and educational status.

The review of literature has reiterated the importance of socioeconomic characteristics of the farmer affecting the output and performance of the farmer. Additionally, economic factors like prices and farm size has also been identified as important predictors of farmer's profitability and technical efficiency. Additionally, yield increases have been found to be as a result of increasing farm sixe. This in itself is not a bad approach, but however not a sustainable one, hence moving towards improving yield quality becomes important for the cocoa farmer and Ghana as a whole. Lastly, the study on the CAA ha found that the longer the person stayed with the CAA program, the higher the profitability for the farmer. These have been identified as important in the literature and hence need to be given attention in any study to understand farmer profitability.

Wiredu et al. (2011) assessed the effect of hybrid cocoa varieties on land productivity of 366 randomly selected cocoa farmers in the Ashanti Region of Ghana. The results confirm the expectation about the effect of improved technologies on the performance of cropping systems. Land productivity is shown to be significantly higher for adopters of hybrid varieties. Correcting for endogeneity using instrumental variable regression procedure, land productivity is expected to increase by 1.84 units and 3.71 units if a farmer decides to adopt and use hybrid varieties. The study reported that strategies to improve the productivity of the cocoa farmers in Ghana should ensure well-targeted promotion of available and proven technologies to minimize the existing adoption gaps. It also recommended that young farmers and smaller households should be the target with sizes of these productivity enhancement policies and programs. Additionally, the study recommended focusing on farmers who are members of farmer based organizations with access to extension service, credit facilities, social amenities and fertilizer.

Svaton (2012) evaluated the long-term productive and economic impacts of the Cocoa Abrabopa Association by evaluating the impacts of joining the CAA in the first, second and third years of the CAA membership and their comparison. The study expected that both the productive and economic returns of the program would be higher in the latter years of sustained membership in the program due to the accumulation of nutrients in the soil and the possibility of the extension of the size of the loan provided by the program. By constructing and estimating a model for the impacts of longer participation, he confirmed the hypothesis of higher economic returns during the 2nd and the 3rd years of participation in the CAA program. However, the study reported that the evidence which would confirm the hypothesis of higher agronomic returns has not been found in the case of CAA.

CHAPTER III: METHODS AND DATA

This section presents a discussion of the data used for the study and of the models employed in analyzing the data and data used in the study. The first section describes the sampling technique used. The second section provides a description of the data collected and the final section an introduction to models used in the study. All econometric and statistical analyses were conducted using the analytical software Stata 11.0.

3.1 Sampling Technique and Data

The data had been collected by TechnoServe Ghana in collaboration with the Cocoa Abrabopa Association to determine the performance of the program since its inception in 2006 through to 2011. A structured questionnaire was developed to gather information relevant to the objectives of the study. Some key questions in the survey sought to identify socioeconomic factors that influenced the yield of the cocoa farmer who has participated in the Abrabopa program over a period. Also, factors such as fertilizer and fungicide use were sought and the profitability that accrues to a participating farmer of the Cocoa Abrabopa Association. The following are description of data collected from respondents and used for the analysis:

- **Membership years:** This is the number of years a farmer has been actively involved in the Abrabopa program. It is expected that when a farmer becomes a member of the association his/her yields, incomes and eventually their livelihoods improve over time.

- **Hectares:** The number of hectares of land a farmer has put into the Abrabopa program. Usually farmers put a portion of their total land area under cocoa cultivation into the program in a particular year. It is expected that the larger the area cultivated by an individual, the higher the probability that they would have larger output.

- **Total Labor Cost:** This constitutes how much a farmer paid for labor during the season. Labor services encompass contracted labor for weeding, pruning, spraying, harvesting and

post- harvest activities. Typically, farmers use casual or permanent laborers depending on the activity to be carried out as well as the skill required to execute a particular activity. Efficient use of labor resources positively influences the performance of the farmer in terms of output and profit.

- **Total Fixed Cost:** Fixed cost items include equipment that usually has a life-span of three years or more. The equipment includes harvesting sickles, aluminum pans and spraying machines.

- **Transportation Cost:** Transportation costs are associated with the transportation of fertilizers and other related inputs to the farm. It also includes the hauling of dried beans to the buying centers. Key factors that affect high transportation cost include the volume of inputs and dried cocoa beans to be transported and the distances over which they are transported. Transportation costs are not expected to have a significant influence on profits because it is assumed those incurring the highest transportation costs are also the larger producers.

- **Beans Sold to Certified Buyer:** Typically, farmers sell their beans to a recognized buyer approved by the program in a particular location. However, sometimes, they may sell through other dealers who work on behalf of trading companies. The outlet used for the sale of cocoa is expected to have a positive impact on profits if it is a certified dealer since the farmer most likely gets the final price.

- **Education:** This is a categorical variable representing the educational level of the farmer. Education is expected to improve the farmer's ability to use of farm inputs and hence affects output or yield of the farmer. Thus, the higher the educational level of the farmer, the higher the probability that s/he will be able to apply farm inputs in the recommended

quantities, and thus increase output and profit. Thus, the study intends to compare the differences in the levels of farmer's education and its effect on output.

- **Age:** This variable captures the age of the respondent. The study measures the influence of the age of the farmer on output performance. It is expected that older growers will be more profitable, probably because of the interactions between age and land and age of trees.

- **Gender:** We measure how gender influences a cocoa farmer's output. Given the physicality of cocoa farming, it is expected that this demographic characteristics would be positive on a producer's performance if the producer is male.

- **Location:** There are seven growing regions of cocoa in Ghana and respondents are identified by where they were located. The location is expected to have an influence on yield and hence on performance.

3.2 Data Description

A total of 4,159 CAA farmers were interviewed. Table 3.1 shows the details of the data per operational area. The number of respondents selected in a region was proportional to the number of Cocoa Abrabopa farmers in that region.

The sample size of those respondents interviewed took into consideration different categories of farmers in the groups who enrolled in the program in different periods, i.e., from 2006 through to 2011 (Table 3.2). The number of participants in the Cocoa Abrabopa Program has been increasing over time, and this is reflected in the proportional increase in the sample in each year. The small representation of the producers selected in 2011 is indicative of the low enrolment in the program in that year. The reason for this is being investigated in another research initiative.

Table 3.1: Sample Size per Cocoa Growing Area

Region	Male	Female	Total	Sample Share
Ashanti	307	108	415	10.0%
Brong Ahafo	179	59	238	5.7%
Central	792	180	972	23.4%
Eastern	582	131	713	17.1%
Volta	94	8	102	2.5%
Western North	662	228	890	21.4%
Western South	667	162	829	19.9%
Total	**3,283**	**876**	**4,159**	**100.00%**

Table 3.2: Number of respondents by Year of Joining CAA

Region	2006	2007	2008	2009	2010	2011	Total
Ashanti	3	22	75	114	201	0	415
Brong Ahafo	1	21	72	98	46	0	238
Central	34	87	148	364	338	1	972
Eastern	30	56	98	174	354	1	713
Volta	16	17	22	34	13	0	102
Western North	24	72	231	259	304	0	890
Western South	26	117	195	262	228	1	829
Total	**134**	**392**	**841**	**1,305**	**1,484**	**3**	**4,159**

3.3 Methodology

Statistical and econometric methods were employed in the analyses of the data. Statistical methods were used to assess the summary statistics of the respondents. The econometric method was used to evaluate the response of profits to the covariates of interest in the model.

The specified model was interested in the covariates for net profits. These were defined as the total revenues from cocoa sales less total costs. Total costs were defined to encompass both variable and fixed costs identified in the data collected from the producers. The estimated model identified demographic and performance variables as influencing net profit. The following equation describes the model.

$$\pi = f(S, A, M, B, Y, L) \tag{1}$$

The variables are described as follows:

π is net profit and a continuous variable.

S is gender of the respondent and it is binary variable with Male = 1 and Female = 0.

A is the age of the respondent in years and is a continuous variable.

M is a categorical variable representing the year in which the respondent joined CAA. The first year of joining CAA is set to 0.

B is a binary variable indication whether the respondent has a bank account. Respondents indicating they have a bank account are set to 1 and those who do not are set to 0.

Y is the yield per hectare of the respondent in tonnes and it is a continuous variable.

L is the location of the respondent. The Volta Region production zone is the smallest of the seven production zones in the country in terms of total land and also production output. Therefore, the Volta Region production zone is set as the reference location (= 0) for the analyses.

The model allows for the estimation of the effect of gender on net profits as a performance indicator for being a member of the Cocoa Abrabopa Program. If the coefficient on gender is positive and significant, then it would imply that males are more likely to have higher and significantly different net profits from female participants in the program. Given the nature of cocoa production – labor intensiveness – it is expected that the coefficient on the gender variable will, indeed, be positive and statistically significant. Age is expected to have a positive and significant effect on net profits because of the potential correlation between age and wealth – measured in land assets and size of operations. The longer respondents have been members of the Cocoa Abrabopa program, the higher their net profits are expected to be. This is because they would have larger land area enrolled in the program and would have benefited from the training and operations support that the program offers it members. Therefore, the coefficients on all years

greater than Year 1 are expected to be positive and significant if, indeed, the CAA program is

delivering it value to its members. Because of the strong correlation between yield and location,

the two variables are combined into an interaction variable and the effect assessed. The model in

Equation 1 was estimated using Ordinary Least Squares. Ordinary Least Squares econometric

approach with STATA® 11 Student Version.

CHAPTER IV: RESULTS AND INTERPRETATION

4.1 Introduction

The results of the statistical and econometric analyses are presented in this chapter. The chapter is organized in three segment. The first presents the descriptive statistics of the variables of interest in this study. The second segment presents the results from the econometric analysis. The third segment addresses the implications of the results.

4.2 Descriptive Statistics

Table 4.1 below presents the descriptive statistics of the variables used in the study. The proportion of males in the sample was about 79 percent, equivalent to 3,274 respondents. The net profit in New Ghana Cedis (GHS) averaged GHS 4,664, with a standard error of GHS 57 and a range of (GHS 4,393) to GHS 45,147. The 95% confidence interval ranged from GHS 4,553 to GHS 4775. The average age of respondents was a little above 50 years. Comparing this average age to the average life expectancy of 61.5 years, this would suggest that the average population in the Cocoa Abrabopa Program is relatively old. With a standard error of 0.2 years, the average age distribution is very tight around the mean.

Table 4.1: Descriptive Statistics of the Variables

Variables	Mean	Std. Err.	95% Conf.		Min	Max
			LL	UL		
Net Profit (GHS)	4,664	56.76	4,553	4,775	-4,393	45,147
Age (Years)	50.41	0.19	50.04	50.77	20.00	96.00
Bank Account (Yes = 1)	0.58	0.01	0.57	0.60	0.00	1.00
Yield (Tonnes/Ha)	1.57	0.01	1.55	1.60	0.24	6.82
Enrolled Area (Ha)	1.29	0.01	1.27	1.31	0.40	8.10
Male (=1)	0.79	0.01	0.78	0.80	0.00	1.00

The average enrolled acreage by respondents was about 1.3 hectares and ranged from less than half a hectare to just above 8 ha. Given the average smallholder holdings of about 4 ha in all crop production, this would suggest either of two things: the Cocoa Abrabopa members have smaller

land holdings or they enroll a lower proportion of their land in the program. Unfortunately, the survey did not ask respondents for their total land holdings and are, thus, unable to confirm this situation. What was expected about gender distribution in the survey was confirmed: males account for about 79 percent of respondents. Cocoa farming is a very labor intensive and, thus, tends to be a male undertaking. However, the fact that only 58 percent of respondents had any type of bank account was not expected. Yet, it is important to recognize this may be a very significant improvement over recent measures. The improvement may be a result of significant initiatives by numerous public policies, private efforts and public-private partnerships (AgFin, 2012).

4.3 Results from the Study

4.3.1 Regression results

The regression results showed that the specified model is statistically significant at the 1 percent level as shown by the F statistic (Table 4.2). The coefficient of determination is 46.2 percent, indicating the goodness of fit of the regression equation. It means that 46.2 percent of the variation in the net profit of farmers is explained by the independent variables used in the model. The results indicate that the influence of gender and the number of years a cocoa farmer has been part of the CAA program were both statistically significant in explaining net profits of respondents. The effect of participation period was as expected as every year of participation increase the impact on net profits. For example, farmers who had two years in the program had about GHS 591 more than those who had only a year in the program. Respondents with three and four or more years' participation respectively had about GHS 1,200 and GHS 1,853 more than participants' with only a year's participation. These coefficients were statistically significant at the 1 percent level. Additionally, participants with bank accounts had net profits of about GHS 296 more than those who did not, and this was significant at the 1 percent level too.

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The yield in Volta production zone was significantly lower than the yield in every other

production zone. For example, while a one tonne increase in yield in the Volta production zone

increased net profit by GHS 1,824, the same increase in the Western South and Central production

zones increased net profits by GHS 4,021 and about GHS 2,777 respectively. Male members of

the CAA program earned a net profit of GHS 237 more than female members, significant at the 1

percent level. The 95 percent confidence interval ranged from GHS 74.46 to GHS 400.18,

indicating that at the confidence level, males had higher net profits than females.

Table 4.2: Results of the Econometric Analysis

Net Profit (GHS)	Coefficient	S.E.	t-stat	P>t	[95% Confidence Interval]	
Gender	237.32	83.07	2.86	0.004	74.46	400.18
Age	6.46	3.52	1.84	0.066	-0.43	13.36
Membership Years (1 = Base)						
2	591.13	78.56	7.52	0.000	437.10	745.16
3	1211.04	119.38	10.14	0.000	976.99	1445.09
4+	1852.29	184.43	10.04	0.000	1490.70	2213.87
Bank Account	296.13	80.38	3.68	0.000	138.53	453.72
Region x Yield						
Volta	1824.29	191.05	9.55	0.000	1449.72	2198.86
Western North	2663.40	86.98	30.62	0.000	2492.86	2833.93
Western South	4021.07	172.39	23.33	0.000	3683.09	4359.04
Central	2776.92	103.36	26.87	0.000	2574.29	2979.56
Eastern	2078.64	84.60	24.57	0.000	1912.77	2244.51
Ashanti	2547.20	128.87	19.77	0.000	2294.54	2799.85
Brong-Ahafo	2507.23	95.26	26.32	0.000	2320.48	2693.99
Intercept	-1079.13	230.42	-4.68	0.000	-1530.88	-627.38
R-Square	0.462	F(2, 4031)	752.60		Prob > F =	0.000

Stata's misspecification test, using the Link test syntax, was applied to determine if the

model was specified correctly. The test involves regressing the dependent variable – net profit – on

the predicted net profit estimated by the model. If the model is not mis-specified, the predicted

outcome should be the only significant variable in the model. As seen in tables 4.3 below, the only

significant variable is the predicted outcome, with a t-statistic of 10.08. The coefficients of both

the square of the predicted net profit from the model and the intercept were not statistically

significant. This would suggest that model used in the estimation was not mis-specified. The

mean variable inflation factor (VIF) was 1.35. This measures the potential risk of multicollinearity

problem in the model. The rule of thumb is that the risk of multicollinearity is low when the mean

VIF is less than 10.

Table 4.3: Specification Test Results

Net Profit (GHS)	Coefficient	S.E.	t-stat	P>t
Net Profit (Predicted)	0.930	0.092	10.080	0.000
Square of Net Profit (Predicted)	0.000	0.000	0.640	0.523
Intercept	180.381	212.653	0.850	0.396

4.4 Discussion of Results

The results from Table 4.2 indicate that, gender and age play a significant role in the

determination of net profits from participation in the CAA program. Cocoa production is a labor-

intensive activity. Therefore, it was expected that the age variable would have a negative

coefficient. However, it did not. Further investigation of the age effect by grouping respondents

into five age groups (20-39 years; 40-52 years; 53-59 years; and 60+ years) showed there was no

significant difference between all the different age groups and the 20-39 years age group except the

53-59 years' age group. The observed difference between the reference group and the 53-59 years'

group was only different at the 10 percent level. It may seem that wealth (land enrolled in the

program) may be the critical explanation of the effect of age instead of age by itself. The

correlation coefficient between age and yield was negative (-0.04) and statistically significant at

the 5 percent level. Likewise, the correlation coefficient between age and net profit per hectare was

negative (-0.03) and statistically significant. Since both yield and net profit per hectare have

enrolled land area in the denominator, it would seem to suggest that wealth, measured as enrolled

land, is the intervening factor influencing the effect of age on net profits.

Gender, unlike age, was indisputable in its effect on net profits. Male members of the CAA produced higher and statistically significant net profits than their female counterparts. This is not independent of the nature of cocoa farming in Ghana. Farming, in general, and the production of cocoa in particular, is labor intensive for major activities such as weeding, pruning and harvesting. Hence, male farmers can afford to provide the requisite manual labor needed to undertake these tasks more easily than females, all things remaining equal. However, males' physical capacity may not be the sole explanatory variable in this result. The correlation coefficients between gender on the one hand and enrolled land and yield on the other are both positive (0.07) and statistically significant at the 5 percent level. These would indicate that males have higher enrolled land and higher yields than females. Thus, while the higher yields may be attributable to the physical capacity differences, the wealth effect may contribute to the significant difference between the genders.

That participation years has a positive influence on net profit is indicative of the contribution of the credit and training that the CAA program offers its members. The results suggest that the longer respondents are enrolled, the higher their net profits, *ceteris paribus*. As indicated, program members receive credit for chemicals as well as husbandry training. They also receive moral support from their peers in dealing with the management of their operations. They may also benefit from collaborative work, which may contribute to lower pecuniary operating costs, leading to higher net profits. It is plausible to envisage the network for collaboration to be higher the longer the individual has been in the CAA program. The correlation coefficient between membership years and yield was 0.12 and significant at the 5 percent level. This implies that the longer people are enrolled in the program, the higher their cocoa yields. Interestingly,

however, the duration of membership also exhibited a positive correlation with total labor cost.

The foregoing correlations are presented in Table 4.4.

Table 4.4: Selected Variable Correlation Coefficients

	Gender	Age	Hectares	Membership Years	Yield	Labor Cost
Gender	1					
Age	-0.03*	1				
Hectares	0.07**	0.01	1			
Membership Years	0.06**	0.05**	0.25**	1		
Yield	0.07**	-0.04*	-0.18**	0.12**	1	
Labor Cost	0.05**	0.01	0.40**	0.13**	0.01	1
Bank Account	0.15**	-0.02	0.05**	0.10**	0.11**	0.07**

* Significant at the 5% level; ** Significant at the 1% level

CHAPTER V: CONCLUSION AND RECOMMENDATIONS

The primary objective of this study was to determine the effect of productivity interventions programs on smallholder cocoa farmers in Ghana who are participating in the Cocoa Abrabopa program. The study was motivated by the need to determine the extent to which Cocoa Abrabopa initiative was providing the expected net profits benefits for its participants. The results are expected to provide input for the delivery of new programs, modification of existing programs or the expansions of the current program.

The research sought to answer a number of questions:

- Does the Cocoa Abrabopa Program offer superior benefits to men vis-a-vis women?

- Does the number of years a farmer practicing Abrabopa on the same piece of land improve yields and eventually incomes?

- Does the region of farming affect and changes a farmer's experience?

- Finally, does age of the farmer affect the performance of the Cocoa Abrabopa farmer?

The study showed that male members of the CAA program gained more in terms of net profits than female members. It also showed that duration of participation has a positive effect on net profits. The effect of location was considered in only one dimension – the difference between Volta Region and the remaining production zones. The results showed that because the reference region was the smallest cocoa producing zone, and net profits is influenced by production volume, there were significant differences between the Volta Region production zone and each of the other production zones. Finally, age was found to be a positive influence on net profits. This was, as indicated, unexpected because of the physical nature of cocoa production. However, our analysis showed that older producers also had access to higher land holdings and other wealth indicators, making it more likely to produce higher net profits.

The longer one's enrolment in the program, the higher their net profits. This is the essence of the study. It indicates that the CAA program is delivering on its value proposition of contributing to members' economic well-being. That newer members generate lower net profit than older members does indicate the importance of the knowledge and skills associated with membership as well as the credit facility that are offered to members. To this end, the activities of the CAA program may be presented to other grower groups as a vehicle of economic development. These groups must be encouraged to stay in the program given the higher benefits – illustrated by the higher net profits – that accrue as a result of membership duration.

The results indicate that net profits are influenced by gender. Male participants in the CAA make more in net profits than their female counterparts. This result presents some policy conundrum because it would suggest, at least superficially, that effort should be invested in males because of the positive effect of the program. However, the correlation analysis revealed that there are some significant resource challenges underlying the outcomes. This illuminates the importance policymakers exploring ways to minimize or eliminate the inherent asset/wealth discrimination that female producers face in cocoa production (and in agricultural production in general in Ghana) (FAO, 2012). Addressing these would require significant and dedicated commitment to change in the traditional communities producing cocoa. For example, communities have to alter their land access and tenural rights to eliminate the inherent bias against females. This would take educating community leaders as well investing in the education of women. There is evidence that families generally invest more in the education of male children than they do in female children but the performance of educated females is not significantly different from that of their educated male counterparts. However, the nature of the solutions suggests investments from when potential

farmers are only children, long before they become decision-makers in the employment of resources in the production decisions.

The correlation analysis showed the importance of yield in the determination of net profits as it was correlated with gender, enrolled land, and membership years. Therefore, it is recommended that the CAA program develop incentives to encourage its members to enroll larger proportions of their land holdings in the program. There is evidence that members only enroll a portion of their cocoa land in the CAA program. The key demographic characteristics of members indicate that older member with higher assets benefit more from the program. Additionally, because members in the Western South production zone produce the highest effect on net profits, the CAA program must endeavor to maximize its enrolment of members in this region.

Unlike the issue dealing with the female disadvantage, addressing the issue of bank account ownership should not be that difficult. Given that the study shows the positive effect of bank account ownership on net profits, it is recommended that the CAA program incorporates in their program offerings the service of helping members open bank accounts and making small savings. There are studies that show that owning a bank account not only helps with more effective decision-making (exhibited by the higher net profits), but encourages savings. When people begin to save, they begin to build capital, which over time allows them to make the requisite investments in their operations. The ability to overcome the perennial credit constraint because in individual producer has access to her own savings or have the ability to use those savings as evidence for credit-worthiness is a significant intangible asset in the potential to transform the poverty and economic wellbeing scenario in the cocoa growing regions of Ghana.

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APPENDIX A: LIST OF ACRONYMS

CAA – Cocoa Abrabopa Association

TNS –TechnoServe

CRIG – Cocoa Research Institute of Ghana

COCOBOD- Cocoa Board of Ghana