

**EFFECT OF INPUT CREDIT SCHEME ON PRODUCTIVITY OF  
SMALLHOLDER COCOA FARMERS IN THE AMENFI WEST AND PRESTEA-  
HUNI VALLEY DISTRICTS OF THE WESTERN REGION:  
A CASE STUDY OF OPPORTUNITY INTERNATIONAL**

**BY**

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**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON, IN  
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## DECLARATION

I, Ramla Baaba Keelson, author of this Thesis, “EFFECT OF INPUT CREDIT SCHEME ON PRODUCTIVITY OF SMALLHOLDER COCOA FARMERS IN THE AMENFI WEST AND PRESTEA-HUNI VALLEY DISTRICTS OF THE WESTERN REGION: A CASE STUDY OF OPPORTUNITY INTERNATIONAL”, do hereby declare that the work presented, with the exception of various forms of literature consulted which have duly been acknowledged, was entirely done by me in the Department of Agricultural Economics and Agribusiness, University of Ghana, Legon under the supervision of senior members of the department. This work has never been presented either in whole or in part for any other degree in this University or elsewhere.

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## **DEDICATION**

This thesis is dedicated to Madam Mary Otuwah Biney (mother) for sponsoring my master's programme and to Mrs. Comfort Afariwa Annan (Late) for contributing positively in my life.

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## ABSTRACT

Opportunity International, a private financial institution has made efforts to support cocoa farmers in Ghana through the establishment of input credit scheme with the aim of enhancing access to inputs to improve productivity of farmers. The primary objective of the study is to determine whether access to inputs improves productivity of smallholder cocoa farmers in the stated districts of the Western Region of Ghana. Purposive sampling was used to select two districts from the region, as well as the communities of interest within the selected districts. Three communities in the Amenfi West and two communities in the Prestea-Huni Valley districts were selected due to the level of participation of farmers in the scheme. A total of 88 participants and 169 non-participants across the communities were selected randomly for the study from the five communities. Factors influencing farmers' participation in the scheme were assessed using a Probit regression model. The PSM method was used to determine the effect of access to credit on productivity of smallholder cocoa farmers. A three-point likert scale was used to identify the severity of constraints faced by participant and non-participant farmers and constraints ranked based on weighted means. Results from the Probit regression indicated farm size, awareness of financial institution, membership of FBO, access to extension agent, location of farmer, timeliness of input supplied, adequacy of loan amount and age as significant factors that influenced participation in the scheme in the study area. Estimation from the PSM revealed the intervention has a positive and significant effect on productivity of participant farmers with participation in the intervention increasing the outputs of participants by 449.9kg/ha compared to non-participants. The fertilizer and agrochemical use were also increased by 84.31kg/ha and 9.95litres/ha, respectively. Respondents identified common constraints faced with the most pressing including poor producer prices and unfavourable weather conditions. It was concluded that the intervention improved the output, fertilizer use and agrochemical use of participant farmers. The study recommends, among others that government provides incentives to help support private credit schemes for cocoa production.

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## ACRONYMS

ATE:	Average Treatment Effect
ATT:	Average Treatment on the Treated
ATU:	Average Treatment on the Untreated
COCOBOD:	Ghana Cocoa Board
PSM:	Propensity Score Matching
FBO:	Farmer Based Organization
GDP:	Gross Domestic Product
CODAPEC:	Cocoa Diseases and Pests Control
LBC:	Licensed Buying Company
CSAE:	Centre for the Study of African Economies
SACCO:	Savings and Credit Cooperative
Kg:	Kilogram
Ha:	Hectare
NNM:	Nearest Neighbour Matching

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background

The agricultural sector in most developing economies contributes significantly to economic growth and development. About 80 percent of farmers engaged in agricultural activities in sub Saharan Africa operate on smallholdings measuring less than 2 hectares with such farms contributing nearly 80 percent of food produced in the world (Busschaert, 2014) with an estimated \$450 billion funds demanded by smallholder farmers worldwide to improve productivity (Carroll *et al.* 2012). These smallholder farmers are faced with common challenges consisting of low output, poor produce quality, limited access to finance, loan repayment default, among others.

In Ghana, the sector contributes immensely to employment especially in the rural areas, providing sources of income, contributing to the country's Gross Domestic Product (GDP) and foreign exchange earnings through the exportation of commodities such as coffee, oil palm and cocoa. Cocoa is the main export crop and contributes more than 9 percent to the total Gross Domestic Product (GDP) and 30% of total export earnings (Quarmin *et al.* 2012) with a total cocoa production export of 896,220 tonnes in 2013/2014 production season (COCOBOD, 2014). Major producers of cocoa in the world are Cote D'ivoire, Ghana and Indonesia with Ghana being the second largest exporter after Cote D'ivoire.

In Ghana, about 6.3 million people representing about 30% of the total population are employed by the cocoa sector (Gockowski *et al.* 2013). Cocoa production in the country

occurs in six regions with over 90% of cocoa grown by smallholder farmers. The Western region produces the highest quantity of cocoa contributing to over 50% of the country's total cocoa output followed by Ashanti, Eastern and Brong Ahafo regions. COCOBOD provides support to cocoa farmers through the purchase and distribution of improved seedlings, fertilizers and agrochemicals at free or subsidized rates. Successive governments through COCOBOD have implemented programmes in a bid to improve the productivity of cocoa farmers in the country. Some programmes undertaken by COCOBOD include CODAPEC and Hi-Tech programme. The CODAPEC programme is aimed at controlling diseases and pests of cocoa in growing areas with the Hi-Tech programme involving the distribution of fertilizers and other agrochemicals at subsidized rates to cocoa farmers.

Even though the agricultural sector contributes significantly to the country's economy, the sector is faced with the lack of interest by most financial institutions in investing or allocating funds to the development of the sector due to the perceived high risky nature of agriculture, failure of farmers to pay back loans, among others (AGRIFIN, 2012).

Baffoe *et al.* (2014) indicate that the lack or limited access to credit by farmers particularly small-scale farmers has resulted in low productivity as farmers are unable to purchase the appropriate inputs for production and has thus reflected in their low income levels. Girabi & Mwakaje (2013) in their study found that farmers are able to improve their agricultural production through access to credit by enabling farmers to purchase the necessary inputs such as seeds, fertilizers, and equipment. To combat this challenge, there is the need to improve productivity of smallholder farmers' through adequate investment in the agricultural sector to ensure the growth of the economy. Awunyo-Vitor (2012)

argues that government in playing their role in improving the agricultural sector ensures credit programmes are developed to make available sources of funds to smallholder farmers to increase productivity and enhance food security through the development of policies to promote easy access to financial services by farmers.

The participation of the private sector is essential to the development of the sector through the provision of portfolio of financial services to actors in the agricultural sector. The emergence of microfinance over the years has been increasingly patronized by people particularly farmers both in the rural and peri-urban centers. The existence of microfinance in the agricultural sector has the tendency of improving outputs of farmers by making available access to credit. This statement is supported by Miller (2011) who believes that the incorporation of microfinance in farm production has the potential to increase output of farmers and improve on their living standards. Again, Miller (2011) indicates that for microfinance to succeed in making credit available to farmers there is the need to approach agricultural microfinance in a different way in order to overcome the challenges in providing agricultural credit. Some financial institutions have made efforts in overcoming the challenges faced in lending to smallholder farmers and one notable institution is Opportunity International.

Opportunity International Limited is a leading savings and loans institution in Ghana which is at the forefront of delivering transformational financial services to help transform the lives of their clients. It was licensed by the Bank of Ghana in the year 2004 and has been in operation since then. The main focus of the institution is to provide financial services to the poor and those who are excluded from the mainstream banking. Opportunity International provides credit to micro, small and medium size businesses that

are viewed as the backbone of most developing countries. The company in diversifying its credit portfolio has incorporated the needs of small holder farmers, agro businesses and entrepreneurs in the agro value chain with the aim of improving the lives of Ghanaian farmers through high yields and thus high incomes. As part of the financial services to farmers, the company provides credit to farmers in kind through the provision of farm inputs (such as fertilizers and agrochemicals) rather than cash. Providing such assets to farmers ensure that the inputs are utilized for the intended purpose and overcome the challenge of limited access to basic farm inputs for production.

### **Operations of Input Credit Scheme**

As one of the financial services to smallholder farmers, Opportunity International has established an input credit scheme which seeks to provide farm inputs in kind to farmers in various areas of crop and animal production. The scheme supports to farmers (particularly cocoa farmers) through the provision of inputs including fertilizers, agrochemicals, protective clothing and spraying machines. Fertilizers in both liquid and granular forms are distributed to cocoa farmers. Other agrochemicals distributed are weedicides, pesticides and fungicides which are mainly in liquid form. Some protective clothing provided is gloves, overall jacket, boots, nose marks and goggles with small sprayers as well as mist blower machines provided by the scheme. To be part of the scheme, a farmer must belong to an FBO within the community. The group serves as security for the credit inputs. Members of the group request for the type and quantities of inputs needed based on recommended product brands by COCOBOD. Farm inputs are mostly requested in the early part of the year (usually between January to March) and delivery done between March and April or earlier depending on when requests are

placed. Distribution of inputs is done at specific places within the various communities according to the request made by individual members of the group.

Payments of the credit inputs are made during the major harvesting period which occurs between September and December allowing for flexibility of payment. Farmers have four months to make payments of the loan. The credit amount consists of the cost of inputs, interest on input cost, distribution cost and a 1% insurance for participant farmers of the scheme. The agricultural staff of the financial institution is responsible for the collection of payment of credit amount by beneficiaries of the scheme in the various communities.

## **1.2 Problem Statement**

Ghana's cocoa sector contributes greatly to the development of the economy through the provision of employment and foreign exchange earnings with the sector partly responsible for poverty reduction in the country particularly among rural people (Vigneri & Santos, 2007 cited in Peprah, 2015). The total production of cocoa in Ghana is mainly contributed by about 90% of smallholder farmers in the country by providing the world with quality cocoa beans. Although cocoa is recognized as the major cash crop and the most important export crop, the sector is chalked with some challenges.

Ghana in about sixty-six years ago had occupied the first position as the highest exporter of cocoa beans in the world until it moved to the second position due to challenges including pests and diseases attack, deteriorating soil quality, unfavorable producer prices among others which resulted in low production of cocoa beans (Anim-Kwapong & Frimpong, 2005).

Ghana's cocoa yields have remained low over the past years compared to other major producing countries such as Cote d'ivoire and Indonesia. Dormon *et al.*(2007) estimated Ghana's cocoa yields at approximately 360kg/ha compared to 800kg/ha in Cote d'ivoire and 1800kg/ha in Malaysia. The low yields have been attributed to the poor control of pests by farmers among others. Subsequent studies by CSAE (2009) indicate that majority of cocoa farmers in the country obtain low yields on an average of 2 ha of cultivated land due to the limited use of fertilizers and pesticides. Ghana and its neighboring country Cote d'ivoire cultivate almost the same farm size of about 1.7 million hectares but the production levels differ. While Cote d'ivoire produces about 1.6 million metric tonnes per annum, Ghana produced a little over 700,000 metric tonnes during its 2014/2015 production season (Adjei-Frimpong, 2016). Anang (2015) also attributed the low yields of cocoa farmers to bad weather, outbreak of diseases and aging cocoa tress.

Successive governments in collaboration with COCOBOD have made significant investments in the cocoa sector in a bid to improve productivity of the farmers. Areas of investments include the free mass spraying of cocoa trees to control diseases and pests attack; distribution of fertilizers at subsidized rates; extensive involvement of extension agents to train farmers among others. These interventions in input supply and the effective implementation of policies resulted in achieving the target of one million metric tonnes of cocoa in the 2010/2011 crop season. But interventions made by successive governments have not achieved much in recent times.

The challenge of improper distribution of farm inputs such as fertilizers and pesticides from government or the LBCs to the farmers has resulted in limited access to these inputs

for use. This indicates that there are gaps in the provision of inputs. This claim is supported by complaints made by cocoa farmers in the Ellebelle district of the Western region where a number of the farmers do not get access to these farm inputs for use (cocobod.gh, 2014). Further claims made by Adjei-Frimpong (2016) shows that the CODAPEC and Hi-Tech programme have not fully been scaled up in parts of cocoa growing areas as farmers complained of lack of access to fertilizers and the free mass spraying.

The private sector has emerged to compliment the efforts of government interventions as government interventions have not yielded much. Private sector assistance includes promoting access to credit to farmers to enhance availability of inputs for use. Smallholder cocoa farmers just like any other farmer are challenged or constrained in accessing inputs thus affecting their level of production and incomes. The challenges in the provision of inputs have drawn the attention of some private organizations in a bid to assist farmers with the needed inputs for use to improve productivity and thus resulted in smallholder farmers participating in credit or agricultural interventions to help increase access to farm inputs to enhance productivity. Such notable institution is Opportunity International, which provides farm inputs to smallholder cocoa farmers through input credit rather than cash credit. This intervention ensures the effective use of inputs and eliminates the diversion of credit to other uses other than its intended purpose. The study then seeks to assess whether or not the input credit provided has yielded any successes by improving on productivity of smallholder cocoa farmers in the Amenfi West and Prestea-Huni Valley districts. The foregoing concerns give rise to the following research questions:

1. What factors influence participation in input credit scheme?
2. What is the effect of input credit scheme on productivity of participant farmers?
3. What constraints are faced by participant and non-participants in the study area?

### **1.3 Objectives of the Study**

The main objective of the study is to assess the effect of Opportunity International's Input Credit Scheme on productivity of smallholder cocoa farmers in the Amenfi West and Prestea-Huni Valley districts of the Western region. This objective was addressed using the following specific objectives:

1. To assess the factors influencing participation in Opportunity International's input credit scheme
2. To determine the effect of the input credit scheme on productivity of participant farmers
3. To identify and rank constraints faced by participant and non-participant farmers

### **1.4 Conceptual Framework**

The cocoa sector contributes significantly to the economic growth and development of the country. The sector is dominated by smallholder farmers who supply about 90 percent of the country's total cocoa output indicating the significance of the contribution of smallholder farmers. The production of cocoa in Ghana has remained low as farmers operate on low levels of productivity as compared to other countries such as Cote D'ivoire and Indonesia. The low levels of productivity have been attributed to a number

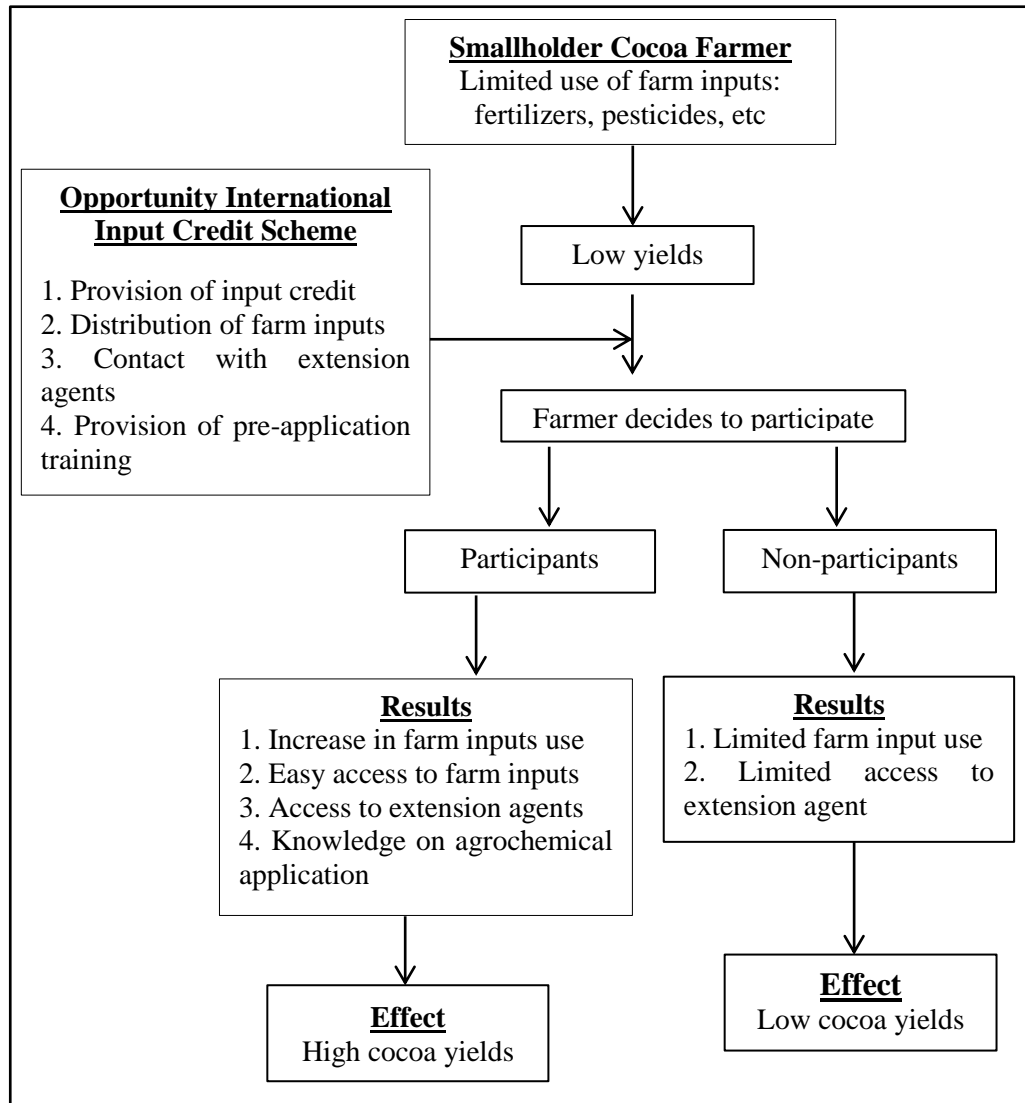
of challenges. Major sources of these challenges are the declining soil fertility of cocoa farms, diseases and pests attack and poor farm management practices. Other major sources are limited use of farm inputs, limited access to credit and inadequate infrastructure.

In a bid to enhance productivity, Opportunity International instituted an input credit scheme to increase farmers' access to farm inputs in selected cocoa growing areas in the country. This has enhanced the availability of credit to the farmers as access to credit has significant means of improving the productivity of smallholder farmers. When farmers are able to access credit, they tend to purchase the needed farm inputs for use such as fertilizers, pesticides, and improved planting materials to enhance productivity. The conceptual framework on the effect of input credit on productivity of farmers is illustrated in Figure 1.1. Smallholder cocoa farmers are the main beneficiaries of the credit scheme and these farmers are characterized by low yields due to low input use and other factors. Participation in input credit scheme is a decision a cocoa farmer makes as he decides to be a member of the scheme or not. The participation in the scheme was thus dependent on the farmer's own observable characteristics.

Participants benefitted from the scheme by first accessing funds on credit from Opportunity International, obtaining credit in kind to avoid the diversion of funds, delivery of farm inputs to the door-step of beneficiary farmers, pre-application training (fertilizer and agrochemical application) by extension agents and the supervision on farms to ensure efficient use of farm inputs. It is expected that farmers who access input credit will be able to improve their levels of production as compared to those who do not access credit at all or access cash credit. The assumption underlying this study is that,

participants of the scheme will have more access to farm inputs for use on their farms and enjoy extension services and are therefore expected to enhance their productivity *ceteris paribus* than farmers who do not benefit from similar intervention. The study tends to determine the effect of input credit scheme on productivity of participants and non-participants.

**Figure 1.1 Conceptual Framework for Input Credit on Productivity of Farmers**



Source: Adopted from Girabi & Mwakaje (2013)

### **1.5 Relevance of Study**

Interventions that are aimed at improving crop productivity of farmers are targeted to increase yields which further results in increases in income, enhancing food security and reducing poverty. This has prompted the need to assess the effect of input credit scheme on productivity of cocoa farmers in the two districts which are cocoa growing areas that produce the highest cocoa beans in the Western region. The study will make available information on whether or not the credit intervention has been viable by improving the yields of cocoa farmers participating in the scheme. The study will provide information on whether or not the intervention has been beneficial to farmers.

The outcome of the research will assist Opportunity International to determine the extent to which the scheme has achieved its expected objective thus serving as evidence for the continuation or termination of the scheme or for further replication or otherwise of similar credit intervention by other financial institutions or private enterprises. Again, knowledge of factors influencing participation in the scheme and identification of constraints will serve as a guide to officials of private enterprises, researchers and other implementers to tailor similar credit interventions to meet the needs of cocoa farmers to enhance productivity.

Finally, the study will contribute to the body of knowledge on the effect of input credit on productivity of cocoa farmers.

### **1.6 Scope and Limitations**

The study focused on two districts out of the ten districts where the input credit scheme has been implemented. This narrows the scope of the study and limits the generalizability

of the findings. The researcher's inability to cover all the ten districts was as a result of time and monetary constraints.

### **1.7 Organization of the Report**

This report is presented in five chapters. Chapter Two reviews related literature on the study and consist of the key areas in the study, empirical studies and continues with factors influencing participation in agricultural interventions, effect of agricultural interventions on productivity of farmers and concludes with the constraints associated with participation in agricultural intervention. Chapter Three presents the methodology and begins with the methods used to achieve each objective of the study, methods of data collection and follows with the study area and ends with discussion of the theoretical and analytical frameworks. Analysis and discussion of the results are presented in Chapter Four. Chapter Five presents the summary, conclusions and recommendations of the study.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 The Cocoa Industry in Ghana

Ghana commenced the commercial growing of cocoa in 1879 with the first shipment of cocoa to Hamburg in Germany in January 1893 (Asuming-Bempong *et al.* 2006). Cocoa has since then remained the major export crop of the country and one of the leading export countries in the world. COCOBOD was established by government in 1947 to be responsible for the development of the cocoa sector. The board was responsible for purchasing, marketing and exporting cocoa produced in the country, as well as establish or encourage the establishment of industrial processing factories for converting cocoa and other cocoa waste into useful cocoa products and finally to regulate cocoa marketing and export. Currently cocoa is produced in six major areas in the country namely: Western, Ashanti, Eastern, Brong-Ahafo, Volta and Central regions. Major cocoa producer countries are Cote d'ivoire, Ghana, Indonesia, Nigeria, Cameroun, Brazil, Ecuador and Malaysia with these countries representing 90 percent of the total production in the world.

The production of cocoa in the country over the past years has been affected by a number of challenges which has resulted in reduced farmer output. Major challenges faced include the prevalence of diseases and pests; decline in soil fertility; unfavorable producer prices; poor weather conditions among others. One of the prevalent causes of low production has been attributed to the presence of diseases and pests such as black pod disease and mirids/capsids. Crop losses were estimated at between 25-35% resulting

from mirid attacks alone and this was due to the low use of pesticides (Osei-Boadu, 2014).

## **2.2 Structure of Credit Market in Ghana**

The financial sector in Ghana comprises of the formal, semi-formal and the informal sectors with their operations guided by legal regulations (Aryeetey, 2008). The formal sector consists of the bank and other specialized non-bank financial institutions in the country. The formal banks are mainly made up of the commercial, universal and development banks. The target clients of these financial institutions are the large businesses as well as the government. These institutions are licensed by the Central Bank and operate under its regulations. The specialized non-bank financial institutions (NBFIs) also licensed by the Bank of Ghana serve a large range of rural people and businesses, and other small and medium enterprises. The NBFIs consist of rural banks, savings and loans companies and micro finance banks. In the semi-formal sector, institutions are legally registered but not licensed by the central bank as a financial institution and they include credit unions, savings and credit co-operatives and microfinance non-governmental organizations (Aryeetey, 2008). The institution draws clients in micro enterprises and other marginalized people. The informal sector serves marginalized and self-employed people and is made up of savings collectors; savings and credit associations; 'susu' groups; traders, agricultural processors and input distributors; money lenders; friends and relatives. Institutions in this sector are not legally registered but may belong to a registered institution.

According to Owusu-Antwi & Antwi (2010) the country's formal financial sector is unable to meet the growing demands of borrowers and as a result, borrowers turn to informal sources of credit. To ensure the efficiency in the financial sector, there is the need for the formal and informal financial sectors to integrate to improve adequate flow of credit.

### **2.2.1 Credit Schemes for Cocoa Farmers in Ghana**

A number of challenges have been faced by Ghana's cocoa sector with successive governments making efforts in arresting such challenges. Governments in collaboration with COCOBOD instituted a number of policy interventions to address challenges faced in the cocoa sector. Two major interventions made by COCOBOD were aimed at improving the production of the cocoa industry through the institution of input schemes. These schemes include the Cocoa Disease and Pest Control Program (CODAPEC) and the High Technology Programme (Hi-Tech).

#### **Cocoa Disease and Pest Control Program (CODAPEC)**

The CODAPEC Programme commonly referred to as "Mass Spraying" was initiated during the 2001/2 cocoa season to assist cocoa farmers in the control of Capsid/Mirid and the Black pod disease. The programme was instituted due to the crop losses the country experienced during the 1990's where losses incurred due to mirid disease accounting for 25-35 percent loss per annum (Osei Boadu, 2014). The programme also provided training to farmers and other technical personnel on how to control pests and diseases (Adjinah & Opoku, 2010). The training involved educating farmers on the dosages of various pesticides, the use of protective clothing, techniques for applying and handling pesticides among others.

The CODAPEC programme is rooted in all seventy-two cocoa growing districts, with thirty-five (35) districts sprayed against the Mirid/Capsid disease, twenty-one (21) districts sprayed against Black pod disease and sixteen(16) districts benefiting from the spraying of both Mirid/Capsid and Black pod diseases in the country during previous years (Oduro & Omane-Adjepong, 2012). The programme for controlling black pod covers all the districts in the Volta, Brong Ahafo and some parts of the Eastern, Ashanti and Western regions while the control of Mirids covers the Eastern, Central and parts of Western and Ashanti regions (Adjinah & Opoku, 2010). Spraying is done by groups at each unit center with farms sprayed thrice between June and October for black pods and twice between August and December in the case of Mirid disease. The farmers are solely responsible for undertaking the necessary cultural practices, providing source of water for spraying as well as monitoring gang spraying on farms.

According to the annual report of COCOBOD (2014), the CODAPEC programme still operated and a total of 126,523 cartons of fungicides and 94,511 cartons of insecticides were distributed for spraying on cocoa farms.

### **Hi-Technology Programme (Hi-Tech)**

The fertilizer application programme mainly called “Hi-Tech” programme was introduced in the 2002/03 crop season. This programme was to address the problem of low productivity due to the decline in soil fertility of cocoa farms resulting from the continuous harvesting of cocoa pods. This was to urge cocoa farmers to boost the application of fertilizers on their farms to help improve their productivity. These fertilizers were supplied on credit to beneficiary farmers at the beginning of the production period and payments were made during the harvesting season in installments

(Mmye, 2007). Figures from annual report of COCOBOD indicate that under the 2013/14 cocoa season, a total of 1,578,970 bags of inorganic granular and 219,869 bags of elite organic fertilizers were distributed to farmers within the cocoa growing areas. Again, a total of 59,959 cartons of lithovit and 68,345 cartons of Sidalco liquid fertilizers were also distributed.

### **2.3 Agricultural Productivity: Definition, Concepts and Measurements**

OECD (2001) defines productivity as the measure of quantities of output produced from quantities of input use. Similar definition is also given by CSLS (2003). Productivity is generally referred to as the ratio of a volume of output measured to a volume of input use (OECD, 2001) and conventionally means the ratio of output to input. Agricultural productivity is defined as the proportion of total farm outputs to total inputs used in the production of agricultural goods. To increase agricultural production, there is the need to increase the quantity and quality of input use such as mechanization, fertilizer use, agrochemical use, improved planting varieties and reliable source of water.

OECD (2001) indicates different types of productivity measures and the measure depends on the purpose of the productivity measurement and to some extent the available data at hand. In broad terms, productivity is measured as single factor productivity (also referred as partial factor productivity) and multifactor productivity measure (or total factor productivity). Single factor productivity measures output to a single measure of input with examples of such measures being labour productivity which is the ration of output to labour input. Land productivity an example of single factor productivity involves the ratio of output to land input. Single factor productivity is mostly used in literature for its

easy computation and reading as indicated by OECD (2001). Although it has its advantages, its major drawback is that the measure does not measure the joint influence of a number of factors used.

Multifactor productivity involves the measurement of output to a collection of inputs (OECD, 2001). This measure is mostly used on industry-level to analyze changes in the industry. This measure is appropriate for measuring technical change by industry when intermediate inputs used in production are fully known. Its disadvantage is that the measure requires significant and timely data for analysis and is mostly done on regional or national level. This measure is not widely used as a measure of productivity but mainly employed in studies involved in macro level analysis.

#### **2.4 Empirical Studies on Access to Agricultural Interventions on Productivity**

Empirical studies on agricultural productivity can be measured on three levels, macro; meso and micro levels. Micro studies help to compare data at different groups at a particular period and usually involves the use of cross-sectional data. Meso studies uses data on a national level for analysis while macro studies uses time series data for analysis.

Analysis of the effect or impact of agricultural interventions has been analyzed using the Propensity Score Matching (PSM) which has been adopted by many researchers. The PSM is an approach used to determine the causal treatment effect of an intervention on the outcomes of the treatment group. It analysis involves the use of two groups, the treatment and control group to determine the effect of an intervention on the treatment group by using a control group to determine what would have been the outcome of the treated group if the intervention did not exist. A binary regression is used to estimate

propensity scores which match some observable characteristics that are similar to both the treatment and control groups. Some studies argue that there is no particular advantage between the use of a probit or logit model in estimating p-scores as they commonly yield similar results even though the logit distribution has more density mass in bounds (Caliendo & Kopeinig 2008). Wainaina *et al.* (2012) employed the logit model arguing that the parameter estimates are consistent with the assumption that the error term has a logistic distribution. The logit model was used to assess the probability of farmers' participation in contract farming as a result of the dependent variable being dichotomous. The Propensity Score Matching was further used to assess the effect of farmers' participation in contract farming on incomes. The result of the study indicated participation in contract farming by farmers has a positive effect on net revenues. Owusu & Frimpong (2014) also employed propensity score matching to determine the impact of cocoa agroforests on yield and incomes of households. Propensity scores were obtained using a logit regression and a matching algorithm using the Nearest Neighbour Matching. The study concluded that the adoption of cocoa agroforest helped farm households to increase yields of cocoa resulting in an increase in incomes of households. Other authors Owusu *et al.* (2011); Adebayo & Olagunju (2015); Davis *et al.* (2009) also used logit regression model to estimate the propensity scores.

Awotide *et al.* (2015) in their study impact of access to credit on agricultural productivity identified access to credit by farmers results in a significant positive effect on productivity of cassava farmers. Frimpong & Owusu (2014) studied impact of cocoa agroforests on yields and household income using cross-sectional data and empirical results showed that the adoption of cocoa agroforests positively impact on yield and

incomes of households. Elias *et al.* (2013) in the study to evaluate the effect of agricultural extension program participation on farm productivity found a positive relationship between access to extension program and farm productivity and employed the Heckman Treatment Effect Model and Propensity Score Matching. The PSM analysis indicated there was a positive impact of participation in extension programme on productivity. Adebayo & Olagunju (2015) also employed the PSM analysis and established that farmers' involvement in agricultural research interventions has a significant impact on rural incomes and productivity. Davis & Mekonnen (2012) also indicate participation in farmer field schools has a significantly positive effect on production and incomes among women in East Africa and employed the PSM analysis to determine the average treatment effect. Similar studies by Agyekum, A.P. (2015) on input credit scheme effects on the adoption of cocoa production technologies and productivity of smallholder cocoa farmers in Ghana identified major determinants of productivity levels in two regions among cocoa arabopra farmers using the Cobb-Douglas production function. The studies revealed that fungicide application positively influenced productivity levels of farmers. Other determinants were household size, experience of the farmer and regional dummies. The study also revealed fertilizer and insecticide application as not statistically significant determinants of productivity levels of cocoa farmers.

A study by Ofosu (2009) on the effect of Darlings Human Development Foundation (DHDF) Microcredit on female cassava farmers' output found that effect of microcredit loan on the output of female cassava farmers was statistically significant at the Agona East district for the 2008 output season. The study assessed the effect using OLS for the

analysis and found the effect of microcredit loan on output, land and hired labour. Result showed that the effect of microcredit on land size was significant at 5 percent. Again, the effect of microcredit loan on hired labour was not significant even though it was positive at 10 percent. The study further revealed that the effect of hired labour on the farmers' output was not significant although it was positive.

A study Agyekum, A.F. (2013) assessed the effect of MiDA intervention on productivity of maize farmers in the Afram Basin of Ghana found out that the intervention improved the productivity of participant maize farmers in the district as compared to the productivity of non-participant maize farmers. The study assessed the effect of the intervention using the PSM with the results revealing that the intervention had a positive and significant effect on the productivity of participant farmers as their yields were increased by 0.6680 Mt/ha.

## **2.5 Effect of Agricultural interventions on Productivity of Farmers**

The agricultural sector in most developing countries is characterized mainly by smallholder farmers whose output contributes immensely to the availability of food and source of raw material for industrial production. This indicates the significance of the sector in promoting economic development especially in sub Saharan Africa. Improvement in agricultural productivity contributes to increasing rural incomes and reducing poverty. The sector of most developing economies are faced with the challenge of low productivity with notable challenge been the lack of access to credit with an estimated 2.5 billion people lacking access to credit worldwide (Baffoe *et al.* 2014 ). When farmers particularly smallholder farmers are able to access credit, they tend to

improve on their levels of production. Baffoe *et al.* (2014) in their study, found a positive correlation between rural credit and agricultural productivity. The results showed majority of the sampled household representing 37% did not have access to credit. Borrowers of credit accessed credit from formal, semi-formal and informal sources with majority of borrowers obtaining credit from formal sources such as rural banks, commercial banks. It was also indicated that through access to credit, smallholder farmers increased their ability to obtain the needed farm inputs for use. Farmers can easily purchase basic variable inputs such as fertilizers, improved seeds, and agrochemicals and also support other off-farm activities. Through access to credit, farmers are able to reduce the challenge of obtaining farm inputs as well as addressing other household cash constraints. The study further showed a positive relationship between access to credit and yields of crop farmers where borrowed households had an impact on yields as compared to non-borrowers. Girabi & Mwakaje (2013) in their study indicate farmers who access credit tend to increase the use of farm inputs resulting in higher productivity as compared to farmers who do not access credit. They opine that, farmers who access credit tend to invest the money in the purchase of much needed inputs such as seeds, fertilizers among others to improve farm production. Farmers who lack access to credit tend to generate low profits from their farm activities as they are unable to invest enough in obtaining farm inputs for production. Fletschner *et al.* (2010) indicate farmers constraints to credit negatively affect the generation of farm profits. Ashaolu *et al.* (2011) argue that through access to credit farmers can easily adopt innovative forms of production technologies that subsequently results in improving the productivity of such farmers.

Agricultural productivity is seen as a means of reducing poverty and increasing the standard of living of farmers particularly rural farmers in most developing countries (Awotide *et al.* 2015) as it contributes to higher farm incomes, ensuring food security and providing raw materials for industrial use. Several agricultural programmes have been implemented by both government and other private sector participants in a bid to improving the agricultural sector of most developing economies. Several studies evaluated the impact of agricultural programmes on productivity and incomes of farmers.

A study by Kudi *et al.* (2009) also assessed the impact of UNDP micro-finance programme on farmers' income. Results indicated that the UNDP micro-finance programme has a positive effect on incomes of participant farmers. Majority of participant farmers indicated that there was minimal improvement in the incomes before participation in the intervention and was represented by 82% of the total respondents. Farmers who participated in the programme indicated that their incomes increased after participation. Owusu & Frimpong (2014) also found a positive correlation between the adoption of cocoa agroforests and yield and household income. Results showed that the average treatment effect of adoption of low shade increased household income by GHC63.96 and with a yield increase by 14.48kg/ha. The impact of medium and high shade also showed positive impact on yield and household incomes. Research conducted by Adebayo & Olagunju (2015) on whether or not agricultural innovation has an impact on improved livelihood and productivity outcomes among smallholder farmers in rural Nigeria reveals that the programme has a significant impact on a number of aspects of livelihood of farmers who produced yam, maize and cassava. Aspect of livelihood such as welfare, income, productivity and fertilizer use were included in the study.

Productivity and welfare outcomes showed a strong positive impact on farmers who participated in the programme with income and fertilizer use having a less positive impact on farmers. Awotide *et al.* (2015) also concluded farmers who obtain credit have higher productivity levels than farmers who did not obtain credit. Other studies by Davis & Mekonnen (2012); Girabi & Mwakaje (2013); Elias *et al.* (2013); Baffoe *et al.* (2014) also assessed the effect of agricultural intervention on agricultural productivity or incomes of farmers in Ghana as well as other African countries.

## **2.6 Factors Influencing Participation in Agricultural Interventions**

The country's agricultural sector is seen as the backbone of the economy and has been named as been responsible for the achievement of the first millennium development goal of reducing the number of people suffering from hunger (Etwire *et al.* 2013). The sector is significant in its contribution to GDP, provision of employment and foreign exchange earnings. Numerous interventions have been implemented in the agricultural sector over the past years with others still being implemented in various parts of the country. It is indicated that the agricultural sector has a direct link to the livelihoods, poverty, technology awareness, adoption, malnutrition and environment (Ashley & Maxwell, 2001) with this direct link resulting in improving the agricultural sector particularly through the promotion of agricultural programmes or projects. In achieving this, there is the need to identify factors which influence farmer's participation in agricultural programmes. According to Nxumalo & Oladede (2013), participation refers to individuals or groups taking part in any development process with the purpose of obtaining self-sufficiency and to improve their standard of living. In Ghana, production of crops is largely rain-fed with limited use of improved technologies such as modernized

machines and equipment, use of improved planting materials, fertilizer and agrochemical application, good agricultural practices thus resulting in low productivity of farmers. This has resulted in farmers participating in agricultural projects with the aim of improving their productivity and living standards. Botlhoko & Oladele (2013) indicate that there is the need to provide a more demand-based and sustainable services to actors of agricultural sector by considering the perceptions, knowledge, diversity and resources of these actors.

Etwire *et al.* (2013) in their study of assessing factors influencing farmer's participation in agricultural projects identified some factors influencing participation in Agricultural Value Chain Mentorship Project (AVCMP) in the Northern region of Ghana. The location of a farmer was anticipated to have a positive or negative influence on whether or not a farmer decides to participate in the project. The age of the farmer was predicted to influence participation indicating that a younger farmer is more likely to participate as they are risk lovers and are attracted to innovation while an older farmer may decline from participating as he or she may already be exposed to the benefits of existed projects or may be resource constrained to participate in a project. The gender of a farmer was expected to have a negative or positive relationship with decision to participate in projects. Males have the tendency of participating as they are usually decision makers and therefore can easily decide to participate. Also, women are likely to participate as they are mostly socially networked and as such may have links with providers of agricultural projects.

The marital status of a farmer was expected to influence participation in agricultural projects as a married person may access information from a spouse about an existing

project as compared to one who is unmarried. On another hand, a married farmer who is conscious of the welfare of his household is likely to participate in projects. Farmer's level of education was expected to positively influence participation as he or she is able to access information and related benefits of available agricultural projects with a more educated person expected to apply the knowledge acquired in school in his farming activities. A farmer's ability to access credit was expected to positively influence participation in agricultural project as these projects mostly provide credit to farmers. A large household size of a farmer was predicted to positively influence participation as each member could relay information about an existing project to other members. Access to extension services was expected to positively affect a farmer's participation in agricultural projects as most project providers gain access to participants through extension agents so once a farmer has contact with an extension agent, the higher the farmer's likelihood to be part of a project. The size of a farmer's farm was expected to have a positive relationship with participation in agricultural projects. A farmer with a larger farm size was likely to participate as he has the ability to access more farm inputs for use on his farm.

The study found out that the number of years in school, access to production credit and agricultural extension service were significant factors that positively influenced the participation of farmers in agricultural projects in the Northern region. It was indicated that farmers who have access to credit are likely to participate in an agricultural project by 15 percent. The results also showed farmers who access agricultural extension services are about 14 percent more likely to participate in agricultural projects. Finally, a

farmer who stays in school for one more year results in a less likelihood of the farmer participating in an agricultural projects by about 2 percent.

Results from a study by Baffoe *et al.* (2014) identified age, education and size of household as factors that positively affect access to credit by borrowers. Borrowers of credit had large households, were more educated and were younger as compared to non-borrowers. Age was found to positively relate with access to credit as young farmers were risk takers compared to older farmers. Also farmers with higher education were likely to read and understand processes involved in acquiring credit and so were willing to borrow.

Another study by Mpiira *et al.* (2013) on the factors influencing household participation in savings and credit cooperative (SACCO) programmes in Uganda assessed the socio-demographic characteristics that may affect participation in SACCO programmes. Characteristics of participants identified in the study were age of household head, age of household spouse, level of education of household head, total working experience of household head, total experience of spouse, experience of household head at current job, spouse's experience at current job. Other variables included in the probit model are distance to district capital, number of visits to town, total number of dependents, total household income, informal loan size received and household assets. Variables that were significant in the study were total working experience of household head; spouse's total experience; spouse's experience at current job. Other variables were distant to district; number of visits to districts and total household income.

Botlhoko & Oladele (2013) in their study assessed factors that influence the participation of farmers in agricultural projects in Ngaka Modiri Molema district in South Africa by identifying variables that affect participation. Variables used in the probit model were age of the farmers, gender, level of education, household size, household head and number of dependents. Other variables used in the model are farm size, farming experience, source of information, source of income, effectiveness of rural development programme, attitudes towards agricultural programmes and constraints faced in participation. The results from the model indicated that four variables significantly influenced participation in agricultural programmes: household size; effectiveness of rural development programme; effectiveness of LRAD and constraints to participation in agricultural projects. It was expected that household size, effectiveness of rural development programme and effectiveness of LRAD positively affect participation in agricultural projects and constraints negatively affecting participation. From the study, 97 percent of farmers were willing to participate in agricultural projects.

Similar studies by Farid *et al.* (2009) also assessed the nature and extent of rural women participating in agricultural and non-agricultural activities in Bangladesh by looking at the socio-economic characteristics of rural women. Age, education, family size, household income, ownership of land, amount of indebtedness and wage rate were variables expected to influence participation in agricultural and non-agricultural activities by women. Analysis from the study indicated that age, amount of indebtedness, level of education, ownership of land and family size were variables that significantly affected participation in agricultural and non-agricultural activities with level of education and ownership of land negatively influencing participation and other variables positively

influencing participation. Wage rate and household income were identified as variables which did not affect participation.

Another study by Ayamga *et al.* (2006) also assessed factors that influence a farmer's decision to participate in micro-credit programmes in the Northern region of Ghana. Socio-economic characteristics of individuals were identified to influence participation in micro-credit programmes as used in similar studies by Farid *et al.* (2009); Etwire *et al.* (2013); Botlhoko & Oladele (2013); Mpiira *et al.* (2013). Variables identified to influence participation were age, level of education, gender and non-farm income. Other variables were household size, value of farm output, number of micro-credit institutions available and distance between borrowers and micro-credit institutions. The results of the study showed that six variables significantly influenced individual's participation in micro-credit programmes.

Level of education and distance between borrower and micro-credit institution showed a negative relationship with participation in micro-credit programmes. It was expected that an individual who has a higher education may be gaining just enough to meet his expenses so will not be interested in borrowing from a micro-credit institution. Also, the shorter the distance from the micro-credit institution, the higher the likelihood of an individual to participate in micro-credit programmes thus indicating a negative relationship with participation in micro-credit programmes. Age, value of farm output, non-farm income and number of micro-credit institutions positively influenced participation in micro-credit programmes.

Similar studies by Danso-Abbeam *et al.* (2016) indicated common socio-economic attributes influencing probability of farmers accessing agricultural credit. Nxumalo & Oladele (2013) in their study identified factors influence participation in agricultural programme by farmers in Zululand district also identified similar socio-economic attributes. Anang *et al.* (2015) also identified common factors that influence smallholder farmers' access to agricultural microcredit in Northern Ghana.

### **2.7 Challenges Associated with Participation in Agricultural Interventions**

Kudi *et al.* (2009) in their study identified some problems faced by beneficiaries of UNDP microfinance programme in Kaduna State. Respondents of the study indicated that the farm credit provided to them were below what was needed. Also respondents indicated that there was so much time spent to secure the needed farm inputs for use. Beneficiaries of the programme responded that equity capital contribution from them was too high.

A study by Ayegba & Ikani (2013) identified some challenges faced by individuals in accessing agricultural credit from formal and informal financial sources. In accessing credit from formal financial sources, majority of respondents agreed that credit applied for took longer time for approval by credit providers as this resulted in receiving loans way after planting seasons have passed. This made recipients not use the loan for the intended purpose for which it was obtained. Other respondents agreed that most financial sources required a form of collateral before credit was obtained. Another challenge faced was the short repayment period of agricultural credit by financial sources. Other challenges identified were the high interest rate on loans; request for a

guarantor of loan; bureaucratic processes involved in accessing credit; lack of financial institutions in the locality and the lack of awareness by respondents on availability of credit.

Similar challenges in accessing agricultural credit from informal financial sources were identified by respondents with majority of respondents naming high interest rate as the major challenge facing them. Another pressing challenge identified was inadequate funds provided to farmers by financial sources. Availability of guarantor for loan acquisition and borrowing history of farmers were not left out.

Similar study by Mpiira *et al.* (2013) also identified problems experienced by participants of Savings and Credit Cooperative (SACCO) programmes in Uganda. Majority of respondents indicated high interest rate as the major problem faced in the programme with an annual interest rate of 36 percent which participants deemed as higher compared to interest rates by other financial institutions. Short payback period for loans was considered a problem by participants as this increased the level of defaults among participants of the SACCO programmes. The study also indicated the processing of loans taken too much time. This resulted in loans coming in at a time which were not applicable for the rightful purpose. Another major problem faced was the inadequate amount of loan provided to participants of the programme as this resulted in farmers not obtaining enough to support agricultural activities. Participants who applied for credit were faced with loan rationing resulting in total rationing out of the programme or the quantity of loans rationed.

The SACCO programmes also exposed participants to other problems which included delayed payments of funds; loan schemes not been flexible; lack of moratorium for borrowers; poor services to participants and the lack of agricultural loan packages for farmers.

### **Summary of literature review**

Key findings from reviewed literature on the effect of input credit programmes or schemes on productivity of farmers mainly result in positive effect where researchers have indicated that when farmers participate in credit programmes, they are able to obtain credit for use by purchasing the needed farm inputs to increase their productivity.

On factors influencing participation in input credit scheme, socio-demographic factors such as age, gender, farming experience, off-farm sources of income household size membership of FBO access to extension agent and awareness of existing lending institution have significant influence on participation in input credit schemes. Models mainly used for analyzing factors influencing participation in credit schemes are the logit and probit regression models.

Finally, constraints faced by beneficiaries of credit schemes or programmes are identified as loan rationing, loan approval taken longer time, requirement of collateral for credit, high interest rate on loans as well as bureaucratic nature of loan acquisition among others.

## CHAPTER THREE

### METHODOLOGY

#### 3.1 Introduction

The methodology employed in the research is presented in this section. It describes the methods used in achieving the objectives of the study and it is outlined in the following sub-sections: research design, methods of analysis, data collection approach, study area, theoretical and analytical frameworks.

#### 3.2 Research design

The research adopted the case study approach. The use of the case study design helps to make in-depth analysis of a single case. Case study as a form of observational study involves analyzing data collected from a population in a specific place at a specific time. A cross-sectional data was used in the analysis. The case comprised of participants of input credit scheme in the study area.

#### 3.3 Method of Analysis

##### 3.3.1 Assessing factors influencing participation in Opportunity International's Input Credit Scheme

Given the objective, it is assumed that smallholder cocoa farmers choose between participating and not participating in the input credit scheme. The respondents are divided into two groups; participant group and non-participant group in the input credit scheme. The latent variable  $y_i$  is the utility index and is defined as the utility a farmer enjoys for participating in the input credit scheme. This is represented as;

$$Y_i = \beta X + \varepsilon. \quad (3.1)$$

Where  $i$  stand for individual farmers,  $\beta$  is the coefficient of the independent variables,  $X$  represents the independent variables and  $\varepsilon$  is the random disturbance and assumed to follow normal distribution. The observed dependent variable is determined by whether exceeds a threshold value and represented as:

$$y_i = \begin{cases} 1 & \text{if } y^* i > 0 \\ 0 & \text{if } y^* i \leq 0 \end{cases}$$

The Probit regression model was used to determine the factors that influence participation in input credit scheme. The Probit model of participation is empirically represented as:

$$Y_{ik} = \beta_0 + \beta_1 X_{1ik} + \beta_2 X_{2ik} + \dots + \varepsilon_{ik} \quad (3.2)$$

where  $Y_{ik}$  is a binary variable representing a smallholder cocoa farmer  $i$  in community  $k$  who participates in input credit scheme or not,  $X_1, \dots, X_n$  are the vector of explanatory variables that may affect a farmer's probability of participating in the scheme and  $\varepsilon_{ik}$  is the normal distributed random error term.

The empirical model for participation in input credit scheme is specified as:

$$\begin{aligned} \Pr(Y=1|x) = & \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Gen} + \beta_3 \text{NuYrSh} + \beta_4 \text{FmExp} + \beta_5 \text{OffInc} + \beta_6 \text{HhSiz} + \beta_7 \text{FmSiz} \\ & + \beta_8 \text{FBO} + \beta_9 \text{Awlend} + \beta_{10} \text{ExtSer} + \beta_{11} \text{Loc} + \beta_{12} \text{TiInp} + \beta_{13} \text{FlxPy} + \beta_{14} \text{Age2} + \beta_{15} \text{AdqLn} \\ & + \varepsilon \end{aligned} \quad (3.3)$$

**Table 3.1 Explanatory variables used in Probit Regression Model**

<b>Variable</b>	<b>Description</b>	<b>Measurement</b>	<b>A-priori expectation</b>
<b>Pr(Y=1 x)</b>	Dependent variable	1-participant, 0-nonparticipant	0-
<b>Age</b>	Age of respondent	Years	+
<b>Age2</b>	Square term for age	Years	-
<b>Gen</b>	Gender of respondent	1-male,0-female	+
<b>NuYrSh</b>	Number of years in school	Years	+
<b>FmExp</b>	Farming experience	Years	+
<b>OffInc</b>	Off-farm income sources	1-Yes, 0-otherwise	+/-
<b>HhSiz</b>	Household size of respondent	Number of persons	+
<b>FmSiz</b>	Size of cultivated farm	Hectares	+
<b>FBO</b>	Member of FBO	1-FBO member, 0-otherwise	+
<b>Awlend</b>	Farmer's awareness of lending institution	1-Yes, 0-otherwise	+
<b>ExtSer</b>	Access to extension agent	Frequency of contact	+
<b>Loc</b>	Location of farmer	1-Amenfi West, 0-Prestea Huni-Valley	+/-
<b>TiInp</b>	Timeliness of input supply	1-Yes, 0 –No	+
<b>FlxPy</b>	Flexibility of payment	1 –Yes, 0 –No	+
<b>AdqLn</b>	Adequacy of loan amount	1-Yes, 0-No	+/-

Age is expected to be positively related to the dependent variable. It is expected that young farmers who are more risk neutral participate in accessing input credit scheme. This is supported by Awotide *et al.*(2015) indicating that a younger farmer is expected to access credit than an older farmer. Etwire *et al.* (2013) also indicate that young farmers have a higher probability of participating in agricultural project than older farmers because the former are risk neutral and ready to embrace innovations. On the other hand, Age2 represent older farmers where it is indicated that older farmers may not be interested in participating in agricultural projects due to their experience and endowment which they may have observed in past projects.

The gender of the farmer is expected to positively influence participation in accessing credit. The variable is a dummy and presented as 1 if respondent is male and 0 otherwise. According to Awotide *et al.* (2015) males have access to credit more than females because of their role as household heads. Motsoari *et al.* (2015) and Botlhoko & Oladele (2013) also observed that male farmers have a higher probability of participating in credit programmes than their female counterparts.

The number of years a farmer spent in school is expected to positively influence participation in agricultural activities. Ayamga *et al.* (2006) expected that the level of education of farmers positively influenced access to credit since more educated farmers are seen as knowledgeable and are able to keep good records of activities which serves as a basis for accessing credit. Other studies from Etwire *et al.* (2013) and Farid *et al.* (2009) predicted that the level of education positively influence participation in agricultural projects since educated farmers are able to put into practice the knowledge obtained in school in their agricultural activities.

Farming experience which is measured as the number of years the farmer is engaged in farming is expected to positively influence a farmer's ability to engage in agricultural activities. Highly experienced farmers tend to have adequate knowledge of their farming activities and are able to make efficient use of farm inputs and engage in good farm management practices to improve yields. Iddrisu (2015) in his study also expected the experience of a farmer to positively influence participation in input credit project

A farmer's engagement in off-farm activities fetching other sources of income help to increase the risk bearing capacity of the farmer. This variable is expected to have a

positive relationship with the dependent variable. This is supported by Ayamga *et al.* (2006) and Iddrisu (2015) indicating that a farmer's engagement in other off-farm activities increases their participation in agricultural activities.

Alternatively, a farmer who engages in other off-farm activities is likely not to participate in any credit programme as the farmer may have little time to participate.

A large household size tends to be cash constrained as they incur high expenditure on food and other household items. This increases the likelihood of the household to access credit. Thus it is expected that a large household size will positively influence the participation in credit programmes (Ayamga *et al.* 2006). Etwire *et al.* (2013) and Farid *et al.* (2009) also expected household size to be positively related to participation in agricultural projects.

Farm size is predicted to positively influence participation in credit programmes as it helps a farmer to get access to farm inputs to improve farm output. Motsoari *et al.* (2015) indicated a likely positive relationship between farm size and farmer's ability to access credit. Etwire *et al.* (2013) also expected farm size to be positively related to participation in agricultural projects as a larger farm size requires more access to inputs and technology. Opoku-Mensah & Agbekporu (2015) also expected firm size and access to credit to be positively related.

Members belonging to a farmer based organization are able to access credit programmes through the participation of other members. The group serves as a form of collateral for accessing such credit facilities and through combined efforts members reduce their risk of default. It is expected that belonging to an FBO increases the likelihood of a farmer to

participate in credit programmes. Opoku-Mensah & Agbekporu (2015) expected a positive relationship between an agricultural firm being a member of a business organization and access to credit.

Farmer's awareness of lending institution in the area increases the farmer's access to credit and is expected to have a positive relationship (Motsoari *et al.* 2015). When a farmer is aware of the existence of a credit programme or an agricultural project, he is more likely to participate in such programmes.

A farmer's access to extension services is expected to be positively related to participation in agricultural programmes since such programmes identify farmers through extension agents. In this case farmers have greater chance of being included as they are well informed about such programmes. Etwire *et al.* (2013) expected farmer's contact with extension services to be positively related to participation in agricultural projects.

The location in which the farmers is located is expected to either influence participation positively or negatively. When a farmer is further away from the financial institution it is located, the farmer may not be interested in participating in the scheme. Also the timeliness of input distributed positively influences farmers participation in agricultural programmes. Once inputs needed by farmers are provided on time particularly at the right season period, it enables the farmer to use such inputs at the right time for increase production.

Payment schedule of loan amount also influences the participation of farmer in agricultural programmes. When payment schedules are flexible for the farmer, he tends to be interested in participating as he or she can get enough time to pay back the loan. On

the other hand, when farmers who borrow money do not have enough time period to pay back loan, it becomes a burden on them and therefore default payment of loan. Lastly, the amount of money a farmer is able to obtain as loan can either positively or negatively affect participation in agricultural projects. When a farmer is not completely rationed out of a loan application, he may not obtain the full amount requested to purchase the needed farm inputs for use since the loan amount is not adequate enough for use.

### **3.3.2 Determination of the Effect of Input Credit Scheme on Productivity**

The propensity score matching technique was used to assess the effect of input credit scheme on productivity of smallholder cocoa farmers. The PSM is an approach used to estimate the causal treatment effects by looking at the difference between the outcome of participants of an intervention with and without treatment (Caliendo & Kopeinig, 2008). The PSM addresses the problem of selection bias as participation in a programme or intervention is non-random and farmers self-select themselves to be part based on some expectation and observable characteristics. The method uses information from non-participants (known as control group) to estimate the outcome of participants (that is treatment group) in the absence of the intervention. In estimating the effect, PSM tends to compare the average outcomes of participants and non-participants of an intervention and this is done by matching the average outcomes of participants and non-participants using propensity scores (p-score)

In using this method, the initial step is to estimate the propensity scores. This is estimated using either a probit or logit model due to the treatment being dichotomous (that is 1 for participants and 0 for non-participants). The model employed is the Probit regression

model as this is selected to achieve objective one of the study. The empirical Probit regression model is stated as:

$$\Pr (Y=1 \mid x) = \beta_0 + \beta_i Z_i \quad (3.4)$$

Where:

$\Pr (1 \mid x)$  is binary dependent variable, where  $\Pr = 1$  is the value for participants of input credit scheme and  $\Pr = 0$  is the value for non-participant of input credit scheme

$Z_i$  denotes a set of farmer's characteristics for participating in the scheme

$B_0$  is the intercept and  $\beta_i$  are the regression coefficients

The probit model regression was run to obtain significant variables that influence participation in input credit scheme with these estimated coefficients used to estimate the propensity scores for each farmer.

After estimating the propensity scores, the next step is to select a matching algorithm which uses the estimated p-scores to match participants to non-participants of the intervention. The Nearest Neighbour Matching algorithm which is the most straight forward matching method was employed in matching and may be 'with replacement' or 'without replacement'. In 'with replacement', an untreated individual can be used more than once when matching where there is oversampling of respondents and 'without replacement' untreated individual is used only once. Replacing untreated individuals tend to increase the average quality of the matching and also reduce the level of biasness (Caliendo and Koepeinig, 2008). The study employs the NNM with replacement. Other matching algorithms include caliper and radius matching and kernel matching methods. Caliper and radius matching, another form of NNM algorithms sets to impose a common

support condition to avoid bad matches and increase matching quality. The matching involves choosing an individual from a comparison group as a matching partner for a treated partner who lies within a propensity range (caliper) and has a propensity score that is closest to the treated partner. Similarly, the radius matching uses many comparison units available within the caliper thus avoiding bad matches and increasing the sampling used. Kernel matching methods are nonparametric matching estimators that use weighted averages of nearly all individuals in the control group to create a counterfactual outcome, thus achieving a lower variance due to the use of nearly all individuals of the group (Caliendo and Koepeinig, 2008).

The next step is to estimate the effect of the intervention and finally conduct a sensitivity analysis. In estimating the effect, the common support region is identified. This area consists of positive balancing scores for both the treatment and comparison groups (Wainaina *et al.* 2012). The common effects identified in project evaluation include the Average Treatment Effect (ATE), Average Treatment Effect on the Treated (ATT) and the Average Treatment Effect on the Untreated (ATU). The ATT measures the effect on participants of the intervention and the ATU measures the effect the intervention would have had on non-participants if they had participated. The ATE measures the effect of the intervention on the sample population. The three effects are estimated in this study and stated as:

$$ATE = E[E\{Y_{1i}/D_i = 1, P(Z_i)\} - E\{Y_{0i}/D_i = 0, P(Z_i)\}] \quad (3.5)$$

$$ATT = E[E\{Y_{1i}/D_i = 1, P(Z_i)\} - E\{Y_{0i}/D_i = 0, P(Z_i)\}/D_i = 1] \quad (3.6)$$

$$ATU = E[E\{Y_{1i}/D_i = 1, P(Z_i)\} - E\{Y_{0i}/D_i = 0, P(Z_i)\}/D_i = 0] \quad (3.7)$$

Where:

$Y_{1i}$  and  $Y_{0i}$  are the outcomes of participants and non-participants in the input credit scheme.

$D_i$  is binary dependent variable, where  $D_i = 1$  is the value for participants of input credit scheme and  $D_i = 0$  is the value for non-participant of input credit scheme

$Z_i$  are the characteristics of cocoa farmer  $i$

$P(Z_i)$  are the propensity scores for each cocoa farmer

Sensitivity analysis is then conducted to check the effect of any hidden biases on the estimated treatment effects and these biases occur when there are unobserved variables which affect the inclusion into treatment group and the outcome variable (productivity) at the same time (Caliendo and Koepeinig, 2008). When these hidden biases occur, there is the need to measure the variables and include in the matching and the treatment effects estimated. This can influence the significance of the effect and may make the results not robust. The Rosenbaum bound test (r-bound test) is usually employed in the sensitivity analysis. According to Wainaina *et al.* (2012) the r-bound is used to test the null hypothesis indicating no change on the treatment effect for different values of unobserved selection bias hence not deciding whether or not hidden biases exist as well as magnitude of the biases.

### **Statement of Hypothesis**

It is expected that participants of input credit scheme in the Amenfi West district have a higher level of productivity as compared to non-participants because participants are able to get more farm inputs to use on their farms. The test for difference of mean productivity of participant and non-participant farmers in the district is hypothesized as:

H<sub>0</sub>: there is no significant difference between the mean levels of productivity of participant farmers and non-participant farmers in the Amenfi West district.

H<sub>a</sub>: the mean productivity level of participant farmers is significantly greater than the mean productivity level of non-participant farmers in the Amenfi West district.

Also, it is expected that participants of input credit scheme in the Prestea-Huni Valley district have a higher level of productivity as compared to non-participants since participants get more farm inputs to use on their farms.

The test for difference of mean productivity of participant and non-participant farmers in the district is hypothesized as:

H<sub>0</sub>: there is no significant difference between the mean levels of productivity of participant farmers and non-participant farmers in the Prestea-Huni Valley district.

H<sub>a</sub>: the mean productivity level of participant farmers is significantly greater than the mean productivity level of non-participant farmers in the Prestea-Huni Valley district.

Again, the study hypothesizes that the mean productivity level of participants or non-participants with access to extension agent will be higher than the mean productivity level of participants or non-participants with limited access to extension agent. The hypothesis is stated as:

H<sub>0</sub>: there is no significant difference between the mean productivity of participants or non-participants with access to extension agent.

H<sub>a</sub>: there is a significant difference between the mean productivity level of participants or non-participants with access to extension agent compared to the mean productivity level of participants or non-participants with limited access to extension agent.

### **3.3.3 Identification and Ranking of Constraints Faced by Cocoa Farmers**

Constraints faced by participants of credit programmes were identified from literature and frequencies attached to the severity of the constraints. The constraints identified included small amount of loan obtained from the scheme, longer time taken to process loan request, delays in distributing farm inputs by suppliers among others. The researcher identified other constraints from respondents through pretesting of questionnaire which included poor producer prices, diseases and pests attack, high cost of inputs, among others. The respondents were made to indicate the severity of constraints based on a three-point likert scale: Disagree (1), Neutral (2) and Agree (3). Weighted mean index is calculated and assigned to each constraint. The highest mean index of constraint indicates the most pressing constraints faced by the respondents and corresponds to the highest value of the likert scale. The lowest mean index is assigned to the least constraint which corresponds to the lowest value of the likert scale. Assignment of weighted mean averages to constraints is done in descending order. Other constraints facing participants and non-participants of input credit scheme are included in the study. The items included in the study are listed in Table 3.2

**Table 3.2 Constraints faced by Cocoa Farmers in the Study Area**

<b>Constraints</b>	<b>Disagree (1)</b>	<b>Neutral (2)</b>	<b>Agree(3)</b>
Unfavorable weather conditions			
Poor producer prices			
High cost of farm inputs			
High cost of labour			
Diseases and pests attack			
Limited access to extension agent			
High interest rate on loan			

The weighted means of constraints identified is used to rank the constraints according to the most pressing to the least pressing by respondents in the study area. The highest weighted means are ranked higher followed by the lowest weighted means of constraints identified

### **3.4 Data Collection**

#### **3.4.1 Types and Sources of Data**

The study was conducted in the Western region of Ghana. The target population was the smallholder cocoa farmers consisting of both participants of input credit scheme and non-participants.

Participant farmers who are included in the study are cocoa farmers who have benefitted from the scheme provided by Opportunity International and have not benefitted from any input credit such as those provided by government or other private interventions for the past two years. Non-participant farmers included in the study are those who have not participated in the input credit scheme provided by Opportunity International and may have benefitted from other input credit by government or other private organizations.

Primary and secondary data were employed in the study. Primary data were gathered through field survey from participants and non-participants of input credit scheme. Secondary data was sought from research literature, articles, journals, thesis and other related books. Other sources are web pages of Opportunity International, COCOBOD, Ministry of Food and Agriculture.

### **3.4.2 Sampling Size and Sampling technique**

A multistage sampling technique was employed in the selection of respondents. The first stage comprised of the selection of districts which was employed with the use of purposive sampling method. The Amenfi West and Prestea-Huni Valley districts were selected due to the high level of cocoa production in the region and the implementation of the scheme within the districts with these districts having a good number of active participants of the scheme. The second stage involved the selection of communities within the districts for the study. This selection was made based on the level of high performing farmer groups within the scheme. In selecting the various communities, purposive sampling was employed. This was achieved with assistance from staff of Opportunity International to indicate the communities. The final stage employed the use of simple random sampling to identify respondents who have benefitted solely from the scheme and non-participants who have not benefitted from the scheme at all. In all, a total of 88 participants were selected from both districts. The number of non-participants interviewed was 169 with 84 respondents drawn from the Prestea-Huni Valley district and the remaining from the Amenfi West district. A total of 257 respondents were interviewed for the study.

### **3.4.3 Survey Instruments**

Data collection was done through the administration of semi-structured questionnaire with a face-to-face interview with smallholder cocoa farmers within the stated districts. Data was collected based on the specific objectives aligning the research. A set of questions was first developed and pretested in the study area in January, 2017 to identify any omissions and questions that were not clear to the respondents. The pretest aided in modifying the questions to finally obtain full set of questions that were administered to the respondents.

### **3.5 The Study Area**

The Western region, the highest cocoa producing region in the country, covers a land area of 23,921 square kilometers representing 10% of the total land size in the country. The region consists of twenty-two (22) metropolitan, municipalities and districts assemblies. Major crops grown in the region are both cash and food crops. Predominant cash crops grown are cocoa, oil palm, rubber and coffee. The region is located in the south-western of the country and is bordered by Cote D'ivoire on the West, Central region on the East, Ashanti and Brong Ahafo regions on the North and on the South by coastline of the Atlantic Ocean. The population of the region according to the 2010 Population and Housing census is 2,376,021 with 1,187,774 males and 1,188,247 representing females. The specific study areas for the research were the Amenfi West and Prestea-Huni Valley districts.

#### **Amenfi West District**

The Amenfi West district is one of the high cocoa producing districts in the Western region contributing about 20 percent of the country's cocoa and is located at the middle

part of the region. The district has a total land size of 1,448.56 square kilometers with Asankrangwa as its capital and a total population of 92,152 consisting of 47,361 males and 44,791 females. It is bounded to the South by Jomoro, Ellembelle and Nzema East districts, to the West by Sefwi-Akontombra and Aowin districts, to the North by Bibiani-Anhwiasse-Bekwai, to the East by Prestea-Huni Valley and Wassa Amenfi Central districts. It lies between latitude 5° 30' and 6° 15'N and longitude 1° 45 W and 2° 11'W.

Agriculture is the major economic activity in the district and employs about 75.6 percent of the active population who are mostly into peasant farming. The district is made up of the semi-deciduous forest in the northern part, the tropical rainforest in the southern part and the transitional zone found between the two vegetation zones. The tropical rainforest produces the heaviest rainfall. Both cash and food crops are produced in the district. The main soil types in the district are the forest ochrosol-oxysols and oxysols with these soils supporting the cultivation of cocoa, oil palm, coffee and rubber as well as food crops including rice, tomatoes, maize, plantain and cassava.

The district is one of the wettest parts of the country with a climatic condition comprising of average annual rainfall from 173mm at the south to 140mm at the north with temperatures ranging from 24<sup>0</sup>C to 29<sup>0</sup>C. Rainy seasons fall within March to July and September to early December with temperatures rising in March and low temperature recorded in August. The prevailing climate supports the growth of both cash and food crops.

The Amenfi West district according to the 2010 Population and Housing census has a total household number of 20,262 with an average household size of 4.5 persons per

household. In the district, about 32.8 percent of the household population is headed by males and 11.8 percent representing female heads. The economically active population (15 years and above) is represented by 71.1 percent with males having the highest proportion of 73.2 percent. Majority of the population in the district are employed in the agriculture, forestry and fishing industry with about 71.6 percent of the total households engaged in agricultural activities with highest engagement in crop farming. Cocoa contributes about 80 percent of incomes earned by farmers with its cultivation in many parts of the district.

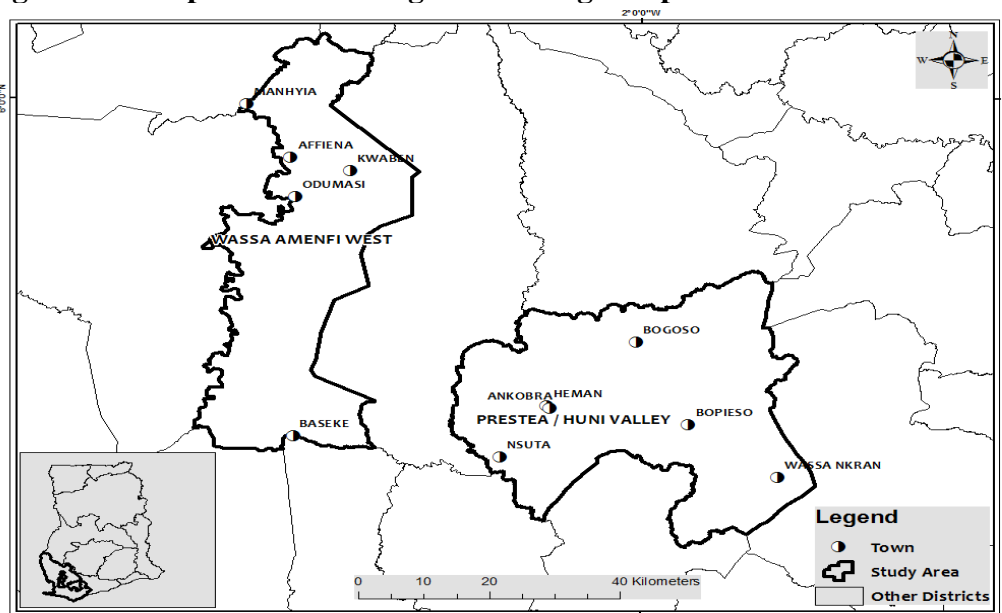
### **Prestea-Huni Valley District**

The Prestea-Huni Valley district is one of the administrative districts in the Western region. It is located at the south-western part of Ghana and constitutes about 7% of the total land area of the region with a total land area of approximately 1,809 square km. It shares boundaries with Amenfi East and Amenfi Central districts in the North, Amenfi West to the West, Tarkwa Nsuaem Municipality to the South and Mpohor Wassa East district to the East. The district is located in the rain forest zone and has two rainfall patterns usually from March to July and from September to November. The mean annual rainfall in the district is 187.83mm with an annual average temperature ranging between 26<sup>0</sup>C and 30<sup>0</sup>C. The vegetation of the district is tropical rainforest which supports the growth of economic trees such as wawa and odum as well as food crops including rice, cassava and plantain. Majority of the population is engaged in agriculture which shows that agriculture remains the backbone of the district.

According to the 2010 Population and Housing Census, the district has a population of 159,304 with males and females represented by 50.5% and 49.5% respectively. The

district population represents about 6.7% of the total population of the region. Population of the district living in rural localities is higher than those in the urban localities and is represented by 62.9% (rural) and 37.1% (urban). The average household size for the district is 4.0 which is a little lower than the regional average of 4.2 with a total household population of 154,528. Majority of the working class age (15 years and above) are mainly engaged in agriculture and forestry. Crop, tree, livestock and fish farming dominate in the district with about 93.7% of households engaged in crop farming and about 28.1% in livestock rearing. The district also contributes to the total production of cocoa from the region with vast lands cultivating cocoa.

**Figure 3.1: Map of Western Region Showing Sampled Districts**



Source: Geography Department, University of Ghana (2017)

### 3.6 Theoretical Framework

The theory underlining the study is the theory of the firm which is an economic theory that focuses on analyzing how a firm makes choices concerning its production in relation

to some factors that affect such choices. The theory of the firm is also useful for analyzing the outcomes of strategies undertaken by firms based on some conditions of imperfect competition (Hart, 2008). The theory of the firm relates to the input-demand function and is defined by the factors of production employed to produce a given level of output. The factors of production employed are capital as a variable cost and land as a fixed cost for production. Considering the input credit provided to cocoa farmers by Opportunity International, input credit provides inputs mainly fertilizers and agrochemicals which are constituents of factors of production for which the farmer pays for on credit basis with quantities of inputs obtained based on the size of the land cultivated. The theory of the firm defining the production of the firm, is adopted to determine the level of inputs use which reflects in the input-demand function;

$$Q_i = f(K, L) \tag{3.8}$$

Where  $Q_i$  is the outcome variable, output

$K$  represents capital employed by the farmer

$L$  is the land cultivated for cocoa production

It is assumed that in the short-run, capital employed is variable and land is fixed, thus output is dependent on level of factors of production used. Capital ( $K$ ) comprises of two components, inputs provided by Opportunity International including fertilizers and other agrochemicals for use on the farms. The other component of capital is the human resource (labour) which is hired by the farmer and he pays for the services of the laborer.

Using the input-demand function, the production of the farmer is determined by the level of inputs used to efficiently produce at a given quantity of output. The study seeks to determine the quantities of inputs provided by the scheme which forms part of the capital component of the input-demand function to assess whether or not the quantities of inputs provided by the scheme to the farmers contributes to the given level of output produced.

### **3.7 Analytical framework**

The study employs the “with” and “without” evaluation method. This method compares two groups (participants and non-participants or treatment and control group) in terms of their behavior by considering key variables that affect both groups. This method uses a comparison group as a proxy for what would have happened to participants of an intervention if the intervention did not exist. In conducting impact evaluation, experimental, quasi-experimental and non-experimental evaluations are used and they basically deal with control groups or non-participants. Experimental research is a method that controls variables that are of interest to the researcher and randomly assigns participants to treatment conditions. Non-experimental research relies on how observational variables relate to each other rather than altering the variables and further describes or interpret the findings of the research while quasi-experiment involves the estimation of causal effect of an intervention on a target population with random selection. Baker (2000) identifies other methods such as difference in difference methods, instrumental variables methods and reflexive comparisons. Instrumental variable method also addresses the problem of selection bias but it is cumbersome to use due to difficulty in finding instruments that has the probability of affecting participation but do not affect outcomes from the participation. Difference in Difference (DiD) approach is a research

design that estimates the causal effect of an intervention or changes in the outcomes of a group of people in which the intervention does not affect every person within an environment at the same time and in the same way (Lechner, 2011). It is suitable to use when confounding variables are controlled or when the use of instrumental variable is not appropriate or when information on pre-treatment is available for use. In using DID, it is important to take into account time when differentiating among groups. Comparison is done based on four different groups where three groups are grouped under those who have not been affected by the treatment. Reflexive comparison method is the evaluation of a group before and after an intervention and it is done using a baseline and a follow-up survey where the impact on participants of an intervention is measured before and after an intervention. The survey conducted before the intervention serves as a baseline survey and a follow-up survey done after participation in the intervention.

Quasi-experimental or Non-experimental designs are methods used to evaluate the effect of an intervention on outcomes of participants. The matching method is widely used by researchers (Wainana *et al.* 2012) in accessing impact evaluations. The expected average treatment effect on the treated (ATT) is estimated and it explains the difference between the outcome variable level of participants and the outcome variable of non-participants which gives a presentation of the outcome of what would have happened if there was no participation in the intervention. The ATT is specified as:

$$ATT = E(Y_{1i} - Y_{0i} / X_i = 1) \quad (3.9)$$

where:

$Y_{1i}$  represents the outcome variable of the  $i^{\text{th}}$  farmer when he participates in the intervention

$Y_{0i}$  represents what the outcome variable of the  $i^{\text{th}}$  farmer had been if he did not participate in the intervention. This results in counterfactual which cannot be measured as compared to the outcome of non-participant which can be measured. The outcome of non-participant group is represented as:

$$E(Y_{0i} / X_i = 0) \quad (3.10)$$

The mean difference between the treatment and control group is specified as:

$$D = E(Y_{1i} / X_i = 1) - E(Y_{0i} / X_i = 0) \quad (3.11)$$

$$D = ATT + U \quad (3.12)$$

where U is represented as:

$$U = E(Y_{0i} / X_i = 1) - E(Y_{0i} / X_i = 0) \quad (3.13)$$

To establish that the ATT has a true parameter, the outcome of the control and treatment groups under the absence of the intervention must be same or equal to zero and is presented as:

$$E(Y_{0i} / X_i = 1) = E(Y_{0i} / X_i = 0) \quad (3.14)$$

Equation (3.13) shows that the error term of the ATT must be the same or equal to zero but the magnitude of the error term cannot be estimated. This is because  $E(Y_{0i} / X_i = 1)$  of the bias equation cannot be measured since the difference between the outcomes of the treated and untreated groups may not be known. Rosenbaum & Rubin (1983) suggested the use of propensity score matching to reduce the self-selection bias in an intervention.

This matching method matches the characteristics of a participant group to a non-participant group with similar characteristics. Other methods have been proposed by other authors to deal with selection bias based on their own underlying assumptions.

The assumptions underlying the propensity score matching is i) conditional independence which states that a given set of observable variables ( $X$ ) must not be affected by the treatment and that the potential outcomes of the treatment assignment are independent (Caliendo & Kopeinig, 2008) and ii) a common support region or overlap condition must be satisfied. This states that individuals with the same observable characteristics must have a positive probability of being both participants and non-participants (Caliendo & Kopeinig, 2008)

## CHAPTER FOUR

### RESULTS AND DISCUSSIONS

#### 4.1 Introduction

This chapter presented discusses the results of the study. It includes the distribution of respondents, description of some socio-demographic, production and institutional variables of smallholder cocoa farmers. It continues with the factors that influence participation in input credit scheme, the productivity levels, the effect of the input credit scheme on productivity and constraints faced by smallholder cocoa farmers in the study area.

#### 4.2 Distribution of Respondents

The distribution of sampled cocoa farmers is presented in Table 4.1. A total of 257 cocoa farmers from two districts in the Western region were used in the study. The districts selected were the Amenfi West and Prestea-Huni Valley. The participants of the scheme were represented by 34% of the total sample with 66% representing non-participants. Thirty-nine participant and seventy-four non-participant farmers were selected from the Amenfi West respectively. In the Prestea-Huni Valley district, participants and non-participants were 49 and 95, respectively.

**Table 4.1: Distribution of Respondents**

District	Participants		Non-participants		Overall	
	Freq.	%	Freq.	%	Freq.	%
Amenfi West	39	44	74	44	113	44
Prestea-Huni Valley	49	56	95	56	144	56
	88	100	169	100	257	100

Source: Field survey, 2017.

### **4.3 Socio-demographic Characteristics of Respondents**

A description of some socio-demographic characteristics of the respondents are represented in Table 4.2 and they include: age, gender, number of years spent in school, household size, marital status, and farmers' main source of income.

The minimum age of participant farmers was 23 years and a maximum age of 74 years with a mean age represented by 48.44 years. For non-participants, the minimum age was 21 years and the maximum age was 90 years with a mean age of 47.79.

Majority of the participants were dominated by males representing 72.7% and females represented by 27.3%. Similarly, the non-participants were dominated by males with a representation of 76.3% and females 23.7%.

Some participants and non-participants of the scheme had no education with maximum formal education of 20 years and 12 years for participants and non-participants respectively. Similarly, mean years of formal education of 9.42 and 4.14 represented participants and non-participants respectively.

A value of 14 represented the maximum household size of participants and a value of 12 represented the maximum household size of non-participants. Minimum value of 1 represented both participants and non-participants household size. A mean household size of 4.76 and 4.14 represented participants and non-participants respectively.

Again, majority of the participants were married (81.8%) with the remaining 18.2% being unmarried (single, divorced and widowed). With non-participants, 81.1% and 18.9% represented those who were married and those otherwise respectively.

Generally, participants who have other off-farm income sources were 19.3% with those not engaged in off-farm income activities being 80.7%. About 18.9% of non-participants were engaged in off-farm incomes activities while 81.1% had no off-farm income sources.

**Table 4.2: Distribution of some Socio-demographic Characteristics of Farmers**

Variable	Category	Participants	Non-participants	Overall	t-test	Sig.
Age (years)	Minimum	23	21	21		
	Maximum	74	90	90		
	Mean	48.44 (1.286)	47.79 (1.075)	48.12	-0.374	0.709
Years of schooling (years)	Minimum	0	0	0		
	Maximum	20	12	20		
	Mean	9.42 (0.494)	4.14 (0.394)	6.78	-4.009	0.000
Household size (number)	Minimum	1	1	1		
	Maximum	14	12	14		
	Mean	4.76 (0.252)	4.14 (0.152)	4.45	-2.224	0.027
Gender	Males	72.7	76.3	75.1		
	Females	27.3	23.7	24.9		
Marital status	Married	81.8	81.1	81.3		
	Otherwise (single, divorced, widowed)	18.2	18.9	18.7		
Off-farm Income sources	Yes	19.3	18.9	19.1		
	No	80.7	81.1	80.9		

Standard Error are in parentheses

Source: Field survey, 2017

#### **4.4 Production Characteristics of Respondents**

Some production characteristics of respondents represented in this section are farming experience, farm size, membership of FBO, fertilizer use and agrochemical use. Table 4.3 presents the production characteristics.

The minimum farming experience of participants was 3 years and a maximum of 43 years. With non-participants, values of 1 and 49 represented the minimum and maximum years of farming experience. Mean years of 17.64 and 16.54 represented participants and non-participants respectively.

All participants belonged to an FBO. Again, about 71.6% of non-participants did not belong to an FBO while 28.4% were members of an FBO.

Generally, the minimum, maximum and mean farm size was represented by 0.8 hectares, 17.2 hectares and 6.98 hectares respectively. Farm sizes of non-participants were 0.6, 12 and 2.97 representing the minimum, maximum and mean farm sizes in hectares. Participants of the scheme applied a maximum of 404kg/ha of fertilizers on their farms while non-participants used a maximum of 300kg/ha of fertilizers. Both participants and non-participants had a minimum of zero application of fertilizers on their cocoa farms. Values of 115.76 and 42.96kg/ha were recorded as mean quantities of fertilizers applied respectively.

**Table 4.3 Production variables of respondents**

Variable	Category	Participants	Non-participants	t-test	Sig.
Farming experience (years)	Mean	17.64 (0.909)	16.54 (0.769)	-0.877	0.381
	Minimum	3	1		
	Maximum	43	49		
Farm size (hectares)	Mean	6.98 (0.369)	2.97 (0.143)	-11.92	0.000
	Minimum	0.8	0.6		
	Maximum	17.2	12		
Fertilizer use (kg/ha)	Mean	115.76 (13.477)	42.96 (6.637)	-5.440	0.000
	Minimum	0	0		
	Maximum	404	300		
Agrochemical use (lit/ha)	Mean	22.78 (2.398)	5.71 (0.476)	-9.234	0.000
	Minimum	0	0		
	Maximum	150	40		
Average age of cocoa tree (years)	Mean	15.34 (0.827)	14.78 (0.695)	-0.492	0.623
	Minimum	3.5	1		
	Maximum	40	50		
Membership of FBO	Yes	(%) 100	(%) 28.4		
	No	-	71.6		

Standard Error are in parentheses

Source: Field survey, 2017

Similarly, both participant and non-participant farmers had a minimum of zero application of agrochemicals on their farms. Participant farmers had a maximum of 150litres/ha application of agrochemicals while non-participants applied a maximum of 40litres/ha of agrochemicals.

The mean average age of cocoa trees of participants and non-participants were 15.34 and 14.78 years respectively. The maximum and minimum average ages of cocoa trees of non-participant farmers were 1 and 50 years, respectively while participants recorded minimum and maximum values of 3.5 and 40 years, respectively.

#### 4.5. Institutional Factors of Respondents

In this section, institutional factors such as access to extension agents, timeliness of farm inputs and awareness of financial institution are presented in Table 4.4.

**Table 4.4 Institutional factors of respondents**

Variable	Category	Participants	Non-participants	t-test	Sig.
Access to extension agent	Mean	3.34 (0.155)	0.89 (0.111)	-12.927	0.000
	Minimum	1	0		
	Maximum	7	7		
Timeliness of farm inputs	Yes	(%) 91	(%) -		
	No	9	-		
Awareness of financial institution	Yes	100	24.3		
	No	0	75.7		

Standard Error are in parentheses

Source: Field survey, 2017

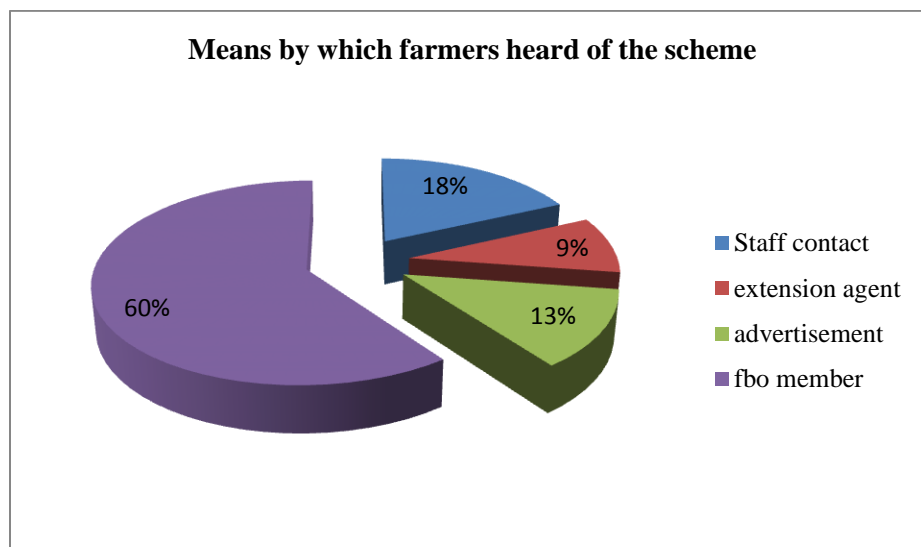
Participant farmers had at least 1 contact with extension agent and a maximum contact of 7. With non-participants, farmers had a zero contact with extension agent and a maximum contact of 7 as with participant farmers.

Overall, all participants of the scheme were aware of the existence of the financial institution and that the institution provided an input credit instead of cash credit to

farmers as well as the terms and conditions involved in being part of the scheme. For non-participants, 24.3% were aware of the existence of the financial institution and the scheme provided to cocoa farmers in the form of input credit while 75.7% of the farmers had no knowledge of the existence of the financial institution and the availability of the scheme. About 91% of participants agreed that the farm inputs were distributed to them promptly while 9% said the distribution was not done on time.

#### 4.6 Means by which Cocoa Farmers Heard of the Scheme

Figure 4.1 presents how farmers heard of the input credit scheme provided by Opportunity International. Majority of the participants heard of the scheme through members of FBO who were already benefiting from the scheme and was represented by 60% of the total sample of participants of the scheme. Personal contact with staff of Opportunity International was the second means farmers heard of the scheme and was represented by 18%, followed by radio advertisement and extension contact with 13% and 9%, respectively.



**Figure 4.1: Means by which farmers heard of the scheme**

#### **4.6.1 Criteria for Selecting Farmers to Participate in Input Credit Scheme**

For cocoa farmers to benefit from the scheme, they are required to satisfy some criteria laid down by Opportunity International. The main criterion for participation in the input credit scheme is to be a member of an FBO within the community in which the scheme is implemented. The purpose of this criterion is for the group to serve as a source of security or form of collateral for obtaining inputs on credit. The second major criterion is for a farmer to relate with extension agents in the community. The extension agents serve as contact between Opportunity International and the cocoa farmers. These extension agents provide some knowledge to cocoa farmers on good agronomic practices in cocoa production. Again, for a farmer to be a participant of the scheme, he/she must open an account with the financial institution. This is to encourage the farmer to save.

#### **4.7 Productivity Levels of Farmers**

Table 4.5 presents the productivity levels of both participant and non-participant farmers. The minimum productivity level (output) of participants is 100.5kg/ha and maximum 1380kg/ha. A minimum and maximum values of 64kg/ha and 1180kg/ha represent outputs of non-participant farmers respectively. Output obtained are from tree crops with maximum ages of 40 and 50 years for participants and non-participants respectively. The mean output level of participants is significantly higher than the mean output level of non-participants.

**Table 4.5 Productivity Levels of Farmers**

Type of Farmer	Obs.	Min. output (kg/ha)	Max. output (kg/ha)	Mean output (kg/ha)	Mean diff (kg/ha)	t-test	Sig.
Participants	88	100.5	1380	697.1 (284.5)	318.01	-15.745	0.000***
Non-participants	169	64	1180	353.1 (208.1)			

Standard Error are in parentheses

Source: Author's computation, 2017

#### 4.8 Factors Influencing Participation in Input Credit Scheme

The Probit model was employed to estimate the parameters of the factors that influence participation in input credit scheme in the study area. The probability value of 0.000 (Prob>Chi<sup>2</sup>) indicates the overall significance of the model meaning the model is significant at 1%. The Pseudo R<sup>2</sup> indicates the extent to which the explanatory variables jointly explain the variations in the dependent variable. A value of 0.7848 means that about 78% of the variations in the dependent variable are explained by the independent variables in the overall model. Overall, the factors that positively influence participation in input credit scheme are farm size, awareness of financial institution, membership of FBO, access to extension contact, location of the farmer, timeliness of inputs and adequacy of loan amount with age negatively influencing participation. However, farming experience, off-farm income sources, household size, gender, flexibility of payment and educational levels of respondents were not significant variables that influenced participation in input credit scheme in the study area.

**Table 4.6 Probit Regression Results of Factors Influencing Participation**

Variable	Coefficient	Std. Error	P>z
Farm size	0.6692	0.1143	0.000***
Awareness of financial institution	0.8349	0.2678	0.002***
Farming experience	0.0192	0.0209	0.357
Member of FBO	0.8210	0.5181	0.000***
Access to extension agent	0.9976	0.3859	0.015**
Off-farm income sources	-0.0477	0.3257	0.883
Gender	-0.8443	0.6188	0.172
Household size	0.0813	0.0624	0.192
Years spent in schools	0.0228	0.0251	0.364
Age	-0.0262	0.0136	0.054*
Location	0.6751	0.4009	0.092*
Timeliness of Inputs supplied	0.8623	0.4355	0.048**
Flexibility of payment	-0.1003	0.3855	0.795
Adequacy of loan amount	1.1740	0.4100	0.004***
Constant	-3.1144	1.1607	0.007
No. of Obs.	257		
Pseudo R <sup>2</sup>	0.7848		
Prob.> Chi <sup>2</sup>	0.0000		

\*, \*\* and \*\*\* implies significance at 10%, 5% and 1% respectively

Source: Author's computation, 2017

The results of the study revealed a positive significance of farm size indicating that the size of a farmer determined the probability of participating in input credit scheme and corresponds to the a-priori expectation. This conforms to Etwire *et al.*(2013) and Motsoari *et al.*(2015) who found that farm/firm size positively influenced participation in agricultural projects as it helps farmers to easily get access to farm inputs to improve farm yields. Baffoe *et al.*(2014) found farm size not significant as factors influencing differences in productivity among household borrowers.

Farmer's awareness of financial institution providing the input credit was found to be significant at 1% as it increases the farmer's access to credit. Once the farmer is aware of the existence of the lending institution, probability of participating in the credit scheme is high and this is consistent with a study by Motsoari *et al.*(2015).

Smallholder farmers who belong to an FBO increased their probability of participating in the scheme. The study revealed that farmers who belonged to an FBO were likely to participate in the scheme by 0.8210. This is consistent with criterion for participating in the scheme by Opportunity International as the major requirement for a farmer to access input credit is for a farmer to be a member of an FBO. Similarly, a study by Mensah & Agbekpornu (2015) and Motsoari *et al.* (2015) found a positive relationship between an agricultural firm being a member of a business organization and access to credit. Ayamga *et al.*(2006) also found a negative relationship between distance between borrower and micro-credit institution.

There was a positive relationship between access to extension agent and the probability of participating in input credit scheme. The study indicated the probability of a cocoa farmer to participate in the scheme was 0.9976 when the farmer has contact with an extension agent. This also conforms to the criterion of the financial institution which indicates for a farmer to benefit from the scheme he should have contact with an extension agent. This is consistent with a study by Etwire *et al.* (2013) who found farmer's contact with extension services to be positively related to participation in agricultural projects.

Again, the study revealed that age of participant farmers determines the probability of participation in the scheme but was negatively related which met the a-priori expectation where it was expected that older farmers who are not risk takers are not willing to participate in an agricultural programme. This contradicts with studies by Awotide *et al.*(2015) and Etwire *et al.* (2013) who found age of a farmer to positively relate to accessing credit and participating in agricultural projects respectively indicating that

young farmers are risk neutral and so would want to access credit or participate in projects. On the other hand an older farmer would want to participate in an agricultural intervention because he may not be more energetic to be involved in other activities to generate funds and so would want to seek assistance from the intervention. Baffoe *et al.* (2014) and Ayamga *et al.* (2006) also found a positive relationship between age and participation in credit programmes.

The study showed a positive relationship between the timeliness of input supply and participation in the input credit scheme, thus the probability of a farmer to participate in the scheme is represented by 0.8623. This reflects in the majority of participant farmers (about 91%) agreeing that the scheme supplied the farm inputs to farmers on time for use before the farming season began. The result conforms to the a-priori expectation where it was expected that the timeliness of input supplied results in influencing participation in the scheme.

Also, the study revealed a positive relationship between adequacy of loan amount and the probability of participating in the input credit scheme. Participant farmers indicated that the quantities of farm inputs supplied in the form of loan credit were enough to cover the use on their cocoa farms. Etwire *et al.* (2013) in their study found that farmers access to production credit influences participation in agricultural projects and this supports the result from the study that once farmers are able to obtain enough production credit, they are willing to participate in the scheme.

The location of a farmer was expected to positively influence participation in the input credit scheme based on the study's a-priori expectation. The result indicated a positive

relationship between the location of the farmer and the probability of participation in the scheme. Cocoa farmers located in the Amenfi West and Prestea-Huni Valley districts are likely to partake in the input credit scheme since these districts are operational districts of the financial institution.

Variables that were not likely to influence participation in the scheme were not consistent with other studies. Bothoko & Oladele (2013) found household size to be a significant factor that affects participation in agricultural projects and was also consistent with Baffoe *et al.* (2014). Again, Baffoe *et al.* (2014) and Ayamga *et al.* (2006) found level of education to be significantly related to credit programmes.

#### **4.9 Propensity Score Matching Analysis of the Effect of Input Credit Scheme on Productivity of Smallholder Cocoa Farmers**

Results of the Probit regression model were employed in the estimation of propensity scores for each farmer. Significant variables obtained from the regression model were used in the propensity score matching. The PSM allowed for participants (treatment group) and non-participants (control group) to be matched thus reducing the level of bias in the study. After the derivation of propensity scores, the common support region is required to validate the quality of the matching scores by discarding propensity scores of treated individuals whose propensity scores lie beyond the range of propensity scores of control individuals. This satisfies the assumption that the probability of participation in the input credit scheme based on observed characteristics lie between 0 and 1 and is not perfectly predicted.

#### **4.9.1 PSM Results of Effect of Input Credit Scheme on Productivity**

The productivity measure of the effect of input credit scheme was based on farmer's output, fertilizer use and agrochemical use. The propensity score matching was done using the Nearest Neighbour Matching algorithm (NNM) with replacement. Table 4.7 presents the results of the estimation. The effect of the input credit scheme on productivity in terms of output is measured in kilograms per hectare. The ATT index indicates the average effect of the intervention on participant farmers. Farmers participation in the scheme increased their output on an average by 449.9kg/ha. This indicates a positive and significant effect at 1% on participants of the scheme. The result conforms to findings by Owusu *et al.* (2011) who found a positive and significant effect of participation in non-farm income on household income. Also, the ATU which presents the average effect of the intervention on non-participants has a positive and significant effect by participating in the intervention. A value of 421.94kg/ha indicates that the productivity of non-participants would have increased by that value if they had participated in the scheme and has a positive and significant effect on non-participants. Also, an ATE of 432.54kg/ha which is significant at 1% indicates that the productivity of the sample population of cocoa farmers in the scheme increased by 432.54kg/ha on the average.

**Table 4.7 PSM results of Input Credit Scheme on Productivity**

<b>Productivity measure</b>	<b>Sample</b>	<b>Treated</b>	<b>Control</b>	<b>Difference</b>	<b>T-stats</b>
Output (kg/ha)	ATT	842.37	392.47	449.9***	4.52
	ATU	476.99	898.93	421.94***	3.91
	ATE			432.54***	4.51
Fertilizer use (kg/ha)	ATT	100.22	15.91	84.31***	2.55
	ATU	45.22	120.72	75.50***	2.02
	ATE			78.84***	2.45
Agrochemical use (lit/ha)	ATT	14.89	4.94	9.95***	3.84
	ATU	8.67	17.61	8.93***	2.13
	ATE			9.56***	3.36

\*\*\* denote significance at 1%

Source: Author's computation, 2017

In terms of fertilizer use, the ATT was 84.31kg/ha which has a positive and significant effect on participant farmers. The result implies that participants of the scheme increased their quantities of fertilizer use on their cocoa farms on an average by 84.31kg/ha. The effect of the intervention on non-participants is presented by an ATU of 75.50kg/ha which has a positive effect. A value of 75.50kg/ha indicates that the quantity of fertilizer used by non-participants on their cocoa farms would have increased by 75.50kg/ha. Also, on an average, the fertilizer use by sample population of cocoa farmers of the scheme presented in the ATE was 78.84kg/ha (significant at 1%).

Overall, an ATE of 9.56litres/ha indicates that the use of agrochemicals of the sample population of cocoa farmers in the scheme increased on an average by 9.56litres/ha. An ATT value of 9.95litres/ha implies the use of agrochemicals by participants of the scheme increased on an average by 9.95litres/ha. Lastly, an ATU of 8.93litres/ha implies the quantity of agrochemicals used by non-participants would have increased by 8.93litres/ha if they had participated in the scheme.

Generally, the values of ATT across the productivity measures of output, fertilizer use and agrochemical use are higher compared to ATU and ATE values. This reveals that cocoa farmers who have a higher probability of participating in the scheme increase their level of productivity compared to farmers who have a less probability of participating in the scheme.

### **Indicators of Matching Quality Before and After Matching**

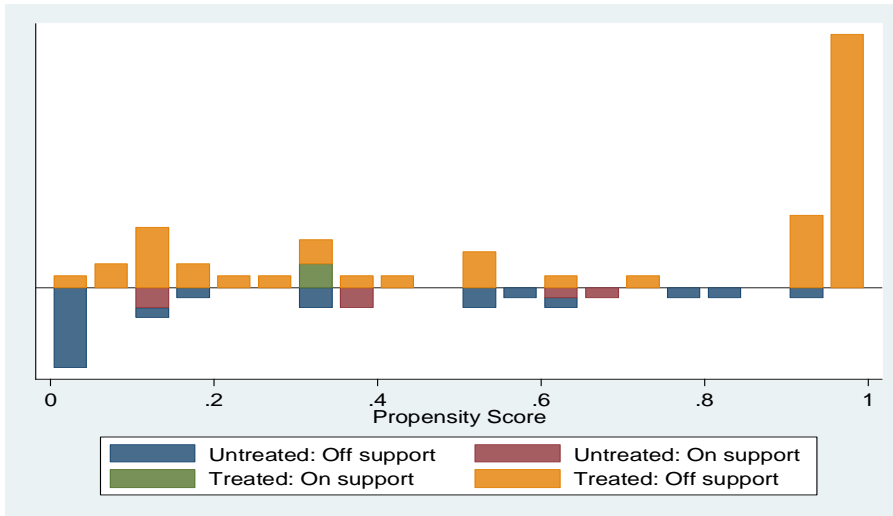
Table 4.8 shows the indicators of matching quality before and after matching. It is observed that the Pseudo R<sup>2</sup> and the Likelihood Ratio test are high and significant before matching with a higher mean bias. But after matching, the Pseudo R<sup>2</sup>, the Likelihood Ratio test as well as the mean bias are low. The low Pseudo R<sup>2</sup> and the Likelihood Ratio test being insignificant satisfy the hypothesis that distribution in covariates of participants and non-participants are the same after matching. These low values imply that the matching of the characteristics have been able to reduce the level of bias of the characteristics of both participant and non-participant farmers. The characteristics of the participants and non-participants are then balanced after matching.

**Table 4.8 Indicators of Matching Quality Before and After Matching**

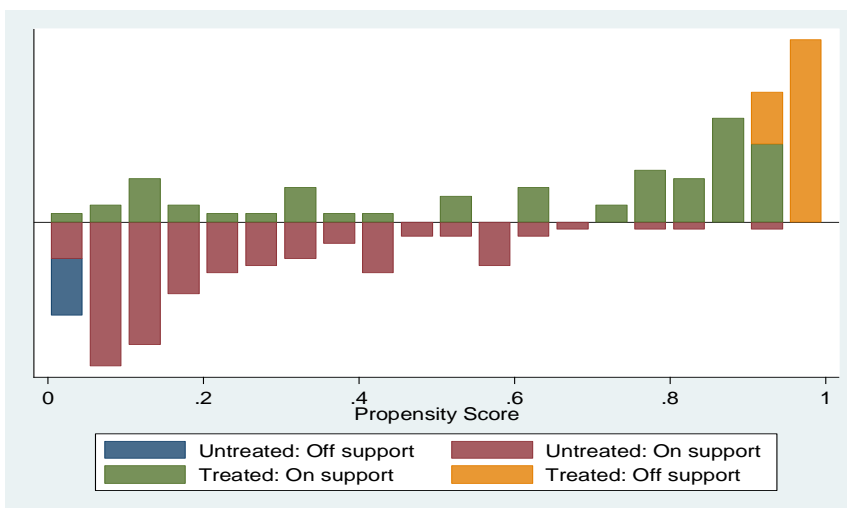
<b>Productivity measure</b>	<b>Sample</b>	<b>Pseudo R<sup>2</sup></b>	<b>LR Chi<sup>2</sup></b>	<b>P&gt;chi<sup>2</sup></b>	<b>Mean bias</b>
Output (kg/ha)	Unmatched	0.677	220.13	0.000	165.4
	Matched	0.047	2.35	0.502	38.3
Fertilizer use (kg/ha)	Unmatched	0.677	220.13	0.000	165.4
	Matched	0.047	2.35	0.50.	38.3
Agrochemical use (lit/ha)	Unmatched	0.677	220.13	0.000	165.4
	Matched	0.047	2.35	0.502	38.3

Source: Author's computation, 2017

**Figure 4.2 Distributions of Propensity Scores**



**Graph Before Matching**



**Graph After Matching**

**4.10 Identification and Ranking of Constraints faced by Farmers**

The study revealed a number of constraints faced by both participant and non-participant farmers of the scheme in the study area. The results revealed the constraints and their mean ranks. Common constraints that were consistent among participants and non-participants were poor producer prices (price of cocoa beans), unfavorable weather

conditions, diseases and pests attack and high cost of labour. Others included high cost of inputs, high interest rate on loans and lack of access to extension agent.

The major constraints occupying the 1<sup>st</sup> and 2<sup>nd</sup> positions faced by participant farmers were poor producer prices, unfavorable weather conditions, high cost of labour and diseases and pests attack. The least constraints were high cost of farm inputs and high interest rate on loan provided in the scheme which occupied the 5<sup>th</sup> and 6<sup>th</sup> positions respectively. Relating to non-participants, the major constraints were poor producer prices, unfavorable weather conditions and high cost of labour which were also commonly faced by participants. The least constraints faced by farmers who were not part of the scheme were limited access to extension agent and high interest rate on loan.

**Table 4.9 Ranked Constraints by Participants and Non-participants of Input Credit Scheme**

Constraints	Participants		Non-participants	
	Mean	Rank	Mean	Rank
Poor producer prices	4.53	1 <sup>st</sup>	4.65	1 <sup>st</sup>
Unfavorable weather condition	4.52	2 <sup>nd</sup>	4.54	2 <sup>nd</sup>
High cost of labour	4.44	4 <sup>th</sup>	4.49	3 <sup>rd</sup>
Diseases and pests attack	4.52	2 <sup>nd</sup>	4.48	4 <sup>th</sup>
High cost of farm inputs	4.42	5 <sup>th</sup>	4.17	5 <sup>th</sup>
Limited access to extension agents	-	-	4.14	6 <sup>th</sup>
High interest rate on loan	4.40	6 <sup>th</sup>	1.53	7 <sup>th</sup>

Source: Author's computation, 2017

The major constraint respondents identified in the study area was the poor producer prices of cocoa. Anim-Kwapong & Frimpong (2005) indicated in their study that one of the major challenges faced by cocoa farmers was poor producer prices. Farmers indicated that the price at which COCOBOD buys their dried cocoa beans was less and as a result have reduced their farm incomes. This further resulted in the unavailable funds to pay for

more farm inputs like fertilizers and other agrochemicals for use to increase their yields and also reduced the number of laborers to engage in farming activities such as pruning, weeding and harvesting.

An unfavorable weather condition was stated as the second most pressing constraint faced by farmers and conforms to a study by Anang (2015). Farmers observed that rains weren't coming as expected during the production year and so their cocoa trees did not get the needed amount of rains for growth as farmers mainly depended on rainfall. It was also indicated that throughout the production year intensive sunshine was experienced resulting in drying up of cocoa leaves and pods. This caused a negative effect on yields obtained during the production period which affected their farm incomes as well.

It was observed that laborers provide services to cocoa farmers in terms of some farming activities such as pruning, spraying and harvesting. Farmers are charged according to the type of activity and the size of the farm with a charge of between GHC20 to GHC60 per person per day. Respondents confirmed that the charges were too high and this affected their farm incomes negatively. Others who were cash trapped were unable to undertake some activities such as pruning on time. Participant farmers of the scheme stated the cost of labour was not catered for by the scheme and this created a major challenge for them as many of them had limited cash to pay for labour services.

The study revealed the presence of diseases and pests in the study area posed a negative effect on production of cocoa in communities of the Amenfi West and Prestea-Huni Valley districts and this is similar to a study by Dormon *et al.* (2007). Major diseases that affected the cocoa pods posed signs such as development of empty pods, black pods

and pest infestation that affected growth of the trees. The presence of diseases and pests resulted in participant farmers demanding more agrochemicals to combat the infestation. This further resulted in higher payments made which subsequently reduced the farm incomes of the farmers. Farmers who were cash trapped particularly non-participant farmers could afford few litres of the agrochemicals while others did not apply any at all on their farms.

Participants of the scheme indicated that the prices of the farm inputs distributed to them were too expensive as compared to inputs on the market. This increased their amount of inputs bought on credit. Non-participants also agreed that the prices of farm inputs such as fertilizers and other agrochemicals on the market are generally expensive and as a result they are unable to buy enough to apply on their farms and others not buying at all. This reduced their farm yields and subsequently reduction in incomes generated from cocoa production.

Also, the study revealed majority of non-participant farmers' had limited contact with extension agent which was a challenge to them as these agents serve as a source of education and training for the farmers. This was evidenced that some farmers had zero contact with extension agents the whole of the year and this affected their production as they needed some guidelines to address the presence of pests and diseases on their cocoa farms. Although this constraint was rated among the least pressing, respondents indicated the limited access to extension agent had a negative effect on production. Majority of the participants of the scheme had at least one contact with an extension agent during the year and report showed farmers were not limited in accessing assistance from these

agents. This is due to the fact that staff of Opportunity International operated through the extension agents within the communities

A common constraint both participant and non-participant farmers faced which occupied the lowest position was the high interest rate on loan. Participants of the scheme revealed the interest rate the financial institution charges on the credit inputs was too high as this reduced the incomes they had after harvesting. Even though the payment of the credit was flexible that is payment made during periods of harvest usually between October to December, farmers complained that an annual interest rate of 42% was high on their part. Due to this constraint, some members of the scheme were contemplating exiting the scheme.

Similar challenge faced was with the rural banks and money lenders in the community. Money lenders were charging 100% interest on loans which posed a major threat to their farm incomes. Non-participants also revealed loans obtained from money lenders were very high and this deterred some farmers from accessing such loans.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter presents the summary, conclusions and policy recommendations based on the findings of the study.

#### **5.2 Summary of the Study**

The primary objective of the study was to analyze the effect of access to input credit on productivity of smallholder cocoa farmers in the Amenfi West and Prestea-Huni Valley districts of the Western Region of Ghana by the input credit scheme. The main objective was achieved by first identifying the factors influencing participation in the scheme with analysis made using the Probit regression model. The second objective which was to determine the effect of access to input credit scheme on productivity was analyzed using the Propensity Score Matching (PSM) approach using the Nearest Neighbour Matching algorithm. With the help of a three-point likert scale, the last objective which was to identify the constraints faced by farmers in the study area was achieved with ranking done based on the weighted means of constraints. Constraints were identified from literature and pretested on the field where respondents also identified other constraints faced.

Purposive sampling technique was employed in selecting the districts in which the scheme was operating and was based on the high level of involvement of the farmers in the scheme. The Amenfi West and Prestea-Huni Valley districts were purposively sampled from the Western region with the aim of obtaining enough respondents since

these two districts had the active members in the scheme. Similarly, the communities visited were purposively sampled from each district and respondents randomly sampled. A total of 88 participant cocoa farmers and 169 non-participant cocoa farmers were selected from both districts.

The results showed farm size, awareness of financial institution, membership of FBO, access to extension agent, location of farmer, timeliness of input supplied, adequacy of loan amount and age of the farmer as factors influencing participation in input credit scheme in the study area. All the variables except age had a positive relationship with probability of participation in the scheme. Farm size, awareness of financial institution, membership of FBO and adequacy of loan amount were significant at 1% with age and location of farmer been significant at 10%. Access to extension agent and timeliness of input were significant at 5%. The Pseudo  $R^2$  for the overall model was 0.7848 indicating the independent variables were able to explain the variations in the dependent variable by 78.48%. The probability value of 0.000 represented by Prob>Chi<sup>2</sup> indicated the overall model was significant at 1%. Other factors that did not significantly influence participation in the input credit scheme were farming experience, off-farm income sources, household size, gender, flexibility of payment and number of years spent in school by respondents.

Again, the study revealed farmers' participation in the input credit scheme has a positive effect on the productivity of participants as it resulted in increases in outputs, fertilizer and agrochemical use. Cocoa farmers who participated in the scheme had their output increased on an average by 449.9kg/ha. The effect of participation in the intervention also increased farmers use of fertilizers on an average by 84.31kg/ha. The quantity of

agrochemicals used by participant farmers also increased on an average by 9.95litres/ha. Also, on an average, farmers who did not participate in the scheme would have increased their output by 421.94kg/ha. Non-participant farmers would have obtained average increases in the use of fertilizers and agrochemicals by 75.50kg/ha and 8.93litres/ha respectively.

Lastly, results from the study indicate both participants and non-participants were faced with common constraints in the production of cocoa. The most pressing constraints faced were the poor producer prices for cocoa and unfavorable weather conditions which occupied the 1<sup>st</sup> and 2<sup>nd</sup> positions respectively. The least constraints faced by participant farmers were high cost of farm inputs and high interest rate on loans. Non-participants identified limited access to extension agent and high interest rate on loans as the least pressing constraints occupying the 6<sup>th</sup> and 7<sup>th</sup> positions respectively. Other constraints identified were high cost of labour and diseases and pests attack on cocoa farms.

### **5.3 Conclusions of the Study**

Results of the study showed farm size, awareness of financial institution, membership of FBO, access to extension agent, location of the farmer, timeliness of inputs, adequacy of loan amount and age of cocoa farmers as factors that influence participation in input credit scheme in the study area. It is concluded that for a farmer to likely participate in the input credit scheme provided by Opportunity International, a farmer must consider the stated factors in order to participate in the scheme. All factors except age had a positive relationship with participation in the intervention.

Empirical results also revealed that the input credit scheme has a positive and significant effect on the productivity of smallholder cocoa farmers in terms of their output, fertilizer use and agrochemical use. It is concluded that farmers who participated in the input credit scheme were able to obtain more farm inputs including fertilizers and agrochemicals for use on their farms. This subsequently resulted in increases in the output of the participant farmers as indicated in the significantly higher access to fertilizers and agrochemicals compared to non-participants.

Lastly, both participant and non-participant farmers are faced with some constraints in cocoa production in the study area. The major constraints faced by farmers are poor producer prices and unfavorable weather conditions with less pressing constraints faced by participants been high cost of farm inputs and high interest rate on loans with non-participants identifying limited access to extension agent and high interest rate on loans as less pressing constraints. Other constraints identified are high cost of labour and diseases and pests attack on farms in the study area.

#### **5.4 Policy Recommendations**

Smallholder cocoa farmers are encouraged to join FBOs in order to benefit from the scheme as this is one of the main criteria by Opportunity International for farmers to participate in the scheme. Also, for farmers to be aware and interested to participate in the intervention, Opportunity International should increase the level of awareness of the scheme through advertisement and frequent staff visits to various communities. Again, the involvement of extension agents must be encouraged to increase the awareness among farmers in other communities within the districts as these agents serve as point of

contact. Opportunity International is also encouraged to continue supplying farm inputs to farmers on time to ensure the inputs are used at the right time to increase production. It is also recommended that Opportunity International maintains or increases the amount of loan in terms of input credit to farmers to ensure more inputs are used on the farms for increased outputs.

Government should provide mechanisms or incentives to help support private credit schemes for cocoa production. This will encourage other organizations or institutions to replicate the scheme in parts of the country to increase farmers' access to fertilizers and other agrochemicals to enhance productivity. Through this intervention, farmers are able to increase their access to farm inputs such as fertilizers and other agrochemicals. This will further boost the supply of cocoa beans on the world market by Ghana.

To encourage production, government should pump in more funds into the stabilization fund to better cushion farmers and protect them against any shocks in the international market to encourage farmers to increase cocoa supply. Ghana in the past years has experienced smuggling of cocoa beans to Cote D'ivoire due to the poor prices offered for the produce. To mitigate this, the government in collaboration with COCOBOD should increase prices offered to cocoa farmers through the stabilization fund to prevent smuggling and improve production. Also, government in collaboration with COCOBOD should employ more agricultural extension agents to liaise with cocoa farmers in the districts in order to increase extension contact. This will help farmers to gain more knowledge about their farming activities.

In addressing the problem of unfavorable weather conditions, farmers are encouraged to adopt climate-smart production systems to help address the over-dependence on weather especially for source of water. Practices such as construction of irrigation systems, planting of shade trees to ward off excessive sunlight and adoption of improved planting varieties can help increase farm yields which subsequently increases farmer's income. This can be achieved through assistance from NGO, other financial institutions and crop research institutes.

Lastly, Opportunity International is encouraged to support farmers with cash to pay for labour as farmers are mostly cash trapped before harvesting thus finding it difficult hiring labour to work on their farms. When labour is not available, some production activities are not able to be undertaken such as pruning, fertilizer application, harvesting among others, thus negatively affecting cocoa yields of farmers. To avoid any misuse of cash credit, Opportunity International must adopt strict procedure for payment to laborers hired to work on farms.

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## APPENDICES

### APPENDIX I Probit regression Results using STATA 14

Probit regression				Number of obs	257	
				LR chi <sup>2</sup> (14)	256.90	
				Prob>chi <sup>2</sup>	0.0000	
Log likelihood		-35.212983		Pseudo R <sup>2</sup>	0.7848	
<b>Inpcb</b>	<b>Coef.</b>	<b>Std. Err</b>	<b>z</b>	<b>P&gt; z </b>	<b>[95% Conf. Interval]</b>	
Gen	-.709609	.439925	-1.61	0.107	-1.571847	.152628
Age	-.026242*	.0136202	-1.93	0.054	-.0529371	.0004531
Age2	0	(omitted)				
NuYrSh	.0299489	.0375132	0.80	0.425	-.0435757	.1034735
HhSiz	.1002701	.1009453	0.99	0.321	-.097579	.2981192
Offarinc	-.9976015	.4512058	-2.21	0.027	-1.881949	-.1132543
Extcon	.9354519**	.3859859	2.42	0.015	.1789335	1.69197
FBO	2.821096***	.5181054	5.45	0.000	1.805628	3.836563
Farmexp	.0192915	.0209501	0.92	0.357	-.0217698	.0603529
Awlend	.8349454***	.2678445	3.12	0.002	.3099798	1.359911
FarSiz	.669232***	.1143591	5.85	0.000	.4450923	.8933717
Loc	.675133*	.4009826	1.68	0.092	1.461045	.1107786
TimInp	.8623215**	.4355093	1.98	0.048	.0087389	1.715904
FlexPyt	-.1002702	.3855338	-0.26	0.795	-.8559025	.6553621
AdqLn	1.174011***	.4100958	2.86	0.004	.3702382	1.977784
Constant	-3.114432	1.160674	-2.68	0.007	-5.389311	-.839553

## APPENDIX II Result of Covariate Balancing Before and After Matching

Variable	Unmatched Matched	Mean		% bias	%reduct  bias	t-test	
		Treated	Control			T	p> t
Gender	U	0.72093	0.7619	-9.3		-0.71	0.479
	M	0.77778	0.72222	12.6	-35.6	0.37	0.710
Age	U	48.488	47.929	4.3		0.32	0.752
	M	47.111	48.056	-7.2	-68.7	-0.25	0.803
NuYrSh	U	9.5	6.756	56.7		4.20	
	M	9.5556	10.056	-10.3	81.8	-0.32	0.748
HhSiz	U	4.7558	4.1488	28.		2.18	0.030
	M	4.3889	4.2222	7.7	72.5	0.31	0.757
Offarinc	U	0.18605	0.18452	0.4		0.03	0.977
	M	0.22222	0.22222		100		1.000
Extcon	U	3.3721	0.8869	171.8		12.9	0.000
	M	2.3333	2.1111	15.4	91.1	0.42	0.674
FBO	U	0.94186	0.28571	181.7		12.58	0.000
	M	0.83333	0.61111	61.5	66.1	1.49	0.145
Awlend	U	0.98837	0.2381	240.8		16.01	0.000
	M	0.94444	1	-17.8	92.6	-1.00	0.324
FarSiz	U	7.0116	3	142.6		11.84	0.000
	M	4.8444	5.9111	-37.9	73.4	-0.86	0.395
Loc	U	0.5122	0.685	103.2		10.84	0.000
	M	0.7682	1.6447	-28.1	57.6	-0.16	0.388
TimInp	U	6.7951	0.644	134.2		4.20	0.847
	M	0.4945	5.8257	31.6	56.1	-10.31	0.752
FlexPyt	U	42.80	0.679	115.3		0.31	0.892
	M	45.6	1	-11.1	40.4	2.18	1.000
AdqLn	U	78.04	0.5	77.2		5.2	0.000
	M	44.72	0.4427	35.1	58.4	-0.25	0.876

<b>Sample</b>	<b>Pseudo R<sup>2</sup></b>	<b>LR chi<sup>2</sup></b>	<b>p&gt;chi<sup>2</sup></b>	<b>MeanBias</b>	<b>MedBias</b>
Raw	0.855	278.07	0.000	83.6	42.4
Matched	0.026	10.95	0.279	17.7	11.5

## QUESTIONNAIRE

### EFFECT OF INPUT CREDIT SCHEME ON PRODUCTIVITY OF SMALLHOLDER COCOA FARMERS IN THE AMENFI WEST AND PRESTEA-HUNI VALLEY DISTRICTS IN THE WESTERN REGION: A CASE OF OPPORTUNITY INTERNATIONAL

Questionnaire number	
Country	
Region	
District	
Community	
Name of enumerator	
Date	..... / ..... / .....
Time of interview	Start time:..... End time:.....
Respondent's contact number	

**Section (1): PERSONAL AND HOUSEHOLD CHARACTERISTICS OF RESPONDENT. PLEASE INDICATE OR TICK WHERE APPROPRIATE.**

1. Name of cocoa farmer .....
2. Gender of cocoa farmer a. Male [ ] b. Female [ ]
3. Age of respondent .....
4. Marital status of respondent a. Married [ ] b. Single [ ] c. Divorced/Separated [ ]  
d. Widowed [ ]
5. Is the respondent the head of the household? a. Yes [ ] b. No [ ]
6. Number of years spent in school.....
7. Household characteristics of respondent

No	First name	Gender	Age	Main occupation	Other activities

**Section (2): FACTORS INFLUENCING PARTICIPATION IN INPUT CREDIT SCHEME**

8. How many years have you been cultivating cocoa? .....
9. Do you belong to a cocoa farmer based organization? a. Yes [ ] b. No [ ]
10. If Yes, how many years have you been a member? Please specify .....
11. Do you have available funds for production? a. Yes [ ] b. No [ ]
12. Are you aware of Opportunity International’s input credit scheme in your community?  
a. Yes [ ] b. No [ ]
13. How long have you been part of the input credit scheme? .....years
14. How did you get to know of the scheme?  
a. FBO member [ ] b. Staff of OI [ ] c. Extension agent [ ] d. Advertisement [ ]  
e. Other, specify.....
15. Is the credit from Opportunity International enough to support your production? a. Yes [ ] b. No [ ]
16. How many contacts have you made with extension officers?.....
17. What are your sources of income?

Source	Amount obtained (GHC)
1.	
2.	
3.	

18. Parcel of cocoa lands

Farm size (ha)	Age of farm	Variety of cocoa	Inputs used per land	Type of input used

19. When do you place in your request for input supply?.....
20. How long does it take to receive the inputs from Opportunity International?.....

21. Where are the inputs delivered to you?.....

**Section (3): EFFECT OF OPPORTUNITY INTERNATIONAL'S INPUT CREDIT SCHEME ON PRODUCTIVITY**

22. OUTPUT OF FARMER

	2015	2016
Quantity of dry seeds from farm (kg)		
Quantity bought by LBC (kg)		
Output price (per kg)		

23. How did you become a beneficiary of the input credit scheme? Please select your option(s)

	Response
Account holder of the financial institution	
Smallholder farmer cultivating at least 2 acres of land	
Relationship with extension officers	
Member of FBO	
Other, specify	

24. Were you oriented on how the scheme operates before joining? a. Yes [ ] b. No [ ]

25. Were you satisfied with the terms and conditions of the scheme before joining?

a. Yes [ ] b. No [ ]

25. If No, please state your reasons.....

26. Have you benefited from the scheme since you joined? a. Yes [ ] b. No [ ]

27. If Yes, please indicate how you have benefitted

Benefit	Response
Timeliness of input supply	
Increase in yield	
Access to extension agent	
Access to pre-application training	
Availability of recommended inputs	
Others, specify	

28. Do you still have interest in participating in the input credit scheme in subsequent crop seasons? a. Yes [ ] b. No [ ]

29. If No, please state your reasons (if any).....
30. Have you received credit for on-farm activities from any financial institution during the last season? a. Yes [ ] b. No [ ]
31. If Yes, which institution provided you with the credit? .....
32. What form did the credit take? a. Cash credit [ ] b. Input credit

**Section 4: CONSTRAINTS FACED BY COCOA FARMERS**

33. Are you faced with any problems in the cultivation of cocoa in your community? a. Yes [ ] b. No [ ]
34. If Yes, please indicate the degree of problems faced by ticking

Constraints	Response		
	Disagree (1)	Neutral (2)	Agree (3)
<b>Credit constraints:</b>			
Loan amount too small			
Longer time taken in processing loan request			
Delays in distributing farm inputs			
Tenure of repayment too short			
Interest rate on loan too high			
High cost of loan application			
<b>Production constraints:</b>			
Unfavourable weather condition			
Lack of access to extension agent			
Poor road network			
Poor producer price			
High cost of inputs			
High cost of labour			
Others, specify			

35. Do you report the challenges (if any) to staff of OI? a. Yes [ ] b. No [ ] c. Not Applicable [ ]
36. If No, please state reason why .....
37. Does staff of OI address your challenges before the next season? a. Yes [ ] b. No [ ]
38. Have you reported these problems to extension officers of COCOBOD? a. Yes [ ] b. No [ ]
39. Have these problems been addressed before the current season? a. Yes [ ] b. No [ ]

**Non-beneficiaries of input credit**

40. Are you able to afford the cost of obtaining inputs during the crop season? a. Yes [ ]  
b. No [ ]

41. If No, how are you able to manage the problem.....

42. If Yes, what is your source of funds? a. Personal [ ] b. Credit [ ]

43. What do you use the credit for?.....

44. Are you able to pay back the credit by the end of the repayment period? a. Yes [ ] b.  
No [ ]

