IMPACT OF CERTIFICATION PROGRAMS ON COCOA PRODUCTIVITY AND FARMERS' WELFARE IN ASHANTI REGION, GHANA

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ABSTRACT

The study focused on understanding the perceptions of cocoa farmers in Ghana regarding the cocoa certification and traceability program, its impact on their welfare, and the factors influencing their participation. A sample of 383 farmers was narrowed down to 380 after data cleaning. The study utilized a perception index based on a Likert scale to gauge farmers' views on various aspects of cocoa certification, finding general agreement on its positive impacts, such as environmental friendliness, increased productivity, and improved well-being and income. However, some statements did not receive as much agreement, indicating areas for improvement.

A probit model analysis identified significant factors influencing participation in the program, including education level, membership in farmer-based organizations, age of the farm, and frequency of extension services. The study also employed propensity score matching to assess the program's effects on productivity, income, and food security. It revealed that certified farmers were more food secure and had higher incomes and productivity compared to non-participants. The analysis of constraints faced by farmers highlighted issues like low premiums, delayed payments, and challenges in accessing improved farming technologies.

The study recommends expanding the cocoa certification and traceability program to include more farmers, given its positive impact on welfare. It suggests that the Ghana Cocoa Board and the government could play a role in scaling up the program to enhance the sustainability of the cocoa industry. Addressing the challenges faced by farmers, such as access to improved technologies and land ownership issues, is also recommended. Finally, the study proposes further research to assess the food security status of cocoa farmers during the cocoa season, providing a comprehensive understanding of the program's impact on their livelihoods.

KEYWORDS

Cocoa Traceability, Sustainability, Cocoa Productivity, Food Security,

1. INTRODUCTION

Ghana is known for its high-quality cocoa beans across the globe because of the favorable climatic conditions in most of the cocoa-growing regions in the country (Aidoo et al. 2015). That is, about six regions that often record rainfall of about 1000-1,500 millimetres per year are ideal for the production of cocoa (Kongor et al. 2019). Over the years, the volume of cocoa produced

in Ghana has seen steady growth, though there have been some ups and downs in recent years. The steady growth of Ghana's cocoa production is more attributed to the increase in cocoa farm size rather than the increase in the yield per hectare. Ghana is recorded to have a lower yield of cocoa per hectare (360 kg ha-1) among major producing countries such as Malaysia which has an average cocoa yield of 1,800 kg ha-1 and Ivory Coast which records a cocoa yield of 800 kg/ha (Nyamekye 2021). In Ghana, cocoa yields are below international averages, proposing prospective room for growth driven by productivity (Ingram et al. 2018).

Cocoa achievable yield is around 1 to 1.5 tons per hectare (Fowler et al. 2017), and some countries like Malaysia (1.8 tons per hectare) are achieving more than the average. Cote d'Ivoire (0.8 tons per hectare) is near to the average, Ghana (0.36 tons per hectare) is far below the average (Aidoo et al. 2015). According to Aliaga et al. (2014), reasons for poor productivity performance include poor farm maintenance practices, planting low-yielding varieties, and the incidence of pests and diseases, etc. It was also reported by Ingram et al. (2018) that Ghana appears to be the least efficient in cocoa production compared to other cocoa-producing countries in West Africa (Ansah et al.2020). Assert that Ghana can increase productivity in cocoa production by improving technical efficiency and/or by improving technical applications and programs that will enhance cocoa farmers' production processes.

However, the poor performance of Ghana's cocoa production cannot be attributed to the farmers only but to other actors in the entire cocoa supply chain. This necessitates actors like the processers (Lindt, Mars, Ferrero, etc), middlemen (LBC), and the mother of Ghana cocoa (COCOBOD) to come together to introduce farmers' empowerment, and sustainability programs that ensure farmer empowerment, yield increment, and sustainability of the entire cocoa industry (Nyamekye 2021). Though Ghana Cocoa Board (COCOBOD) has covered several intervention projects and programs over the years, such as rehabilitation projects, mass spraying, cocoa hand pollination, etc. to increase productivity and improve cocoa sustainability in Ghana. The cocoa certification and traceability program are one of the major programs that are carried out by cocoa processors and License-buying companies to ensure farmer empowerment, yield increment, and sustainability of the entire cocoa industry. The cocoa certification and traceability also cover some societal issues like child and forced labour, deforestation, and Fairtrade (Fowler et al. 2017). Sustainability programs in cocoa have had a somewhat controversial history, stemming from issues such as child labour, low prices, and politics, all of which still have a strong influence on the structure of the cocoa industry today (Mol et al. 2015).

Cocoa certification and traceability have become vital assets in cocoa production, which ensure that cocoa farmers are well integrated into the cocoa value chain (Griek et al. 2010). Griek et al. (2010) added that this seriously outlines the roles and responsibilities of farmers in the manufacturing of the cocoa final product. Certification and traceability create a strong contractual relationship between all the actors within the cocoa value chain as well as ensure farmer inclusion

(Jagoret et al. 2018). This brings about shared responsibilities and shared benefits among all the actors in the value chain including farmers. The certification and traceability program are aimed at improving the livelihood of smallholder farmers whilst enhancing sustainability in the cocoa supply chain (Ingram et al. 2018). Worldwide accepted certification standards such as Rainforest Alliance, UTZ certified and Fairtrade organizations exist to mainly provide standards for various certification programs that focus on farmers (Griek et al. 2010). Thus, increases the yield and income of farmers, which improves the standard of living of farmers (Islam 2015).

Though the cocoa certification and traceability program focuses on the welfare of the farmers, it also ensures that cocoa beans are produced and handled in the best possible ways to ensure the

safety of the final consumers (Griek et al. 2010). As a result, many kinds of agro-chemicals are not being used by certified farmers in their cocoa production. In addition, cocoa certification and traceability also cover social issues like child labour, forced labour, wildlife production, and other climate and environmental issues (Fowler et al. 2017). Fowler et al. (2017) Added that these are meant to ensure that the activities of the cocoa farmers do not negatively affect the environment as well as not support activities that disturb the rights of people.

However, not all cocoa farmers are a participant in the cocoa certification and traceability program, even though the cocoa certification and traceability program is available in all the cocoa-growing regions in Ghana (Ollendorf et al 2022). The certification and traceability program is a voluntary program that does not force cocoa farmers to participate. The cocoa certification and traceability is practiced in many parts of the cocoa growing districts in Ghana, including the Effiduase cocoa district (which is the study area) have experienced low cocoa farmer's participation in the cocoa certification and traceability program (Ollendorf et al 2023). Moreover, cocoa certification has become the order of the day in the cocoa industry, where processors and manufacturers in the value chain are in high demand for certified beans. Certification and traceability is known to increase farmers' productivity and enhance farmers' standard of living or welfare as well as ensure sustainable cocoa production.

Hence, the need to assess the perception of farmers on the cocoa certification and traceability program as well as the impact of the certification program on farmers' welfare. Therefore, this study seeks to examine the impact of cocoa certification and traceability programs on cocoa farmers' welfare (cocoa productivity, cocoa income, and food security status of the farmers) and the overall perception of cocoa farmers in the Effiduase cocoa district, on the cocoa certification and traceability program. Specifically, the paper answers the following key questions:

1. What are the perceptions of farmers regarding the implementation and benefits of cocoa certification and traceability programs?
2. What are the factors that influence farmers' decisions to participate in cocoa certification and traceability programs?
3. What is the impact of cocoa certification and traceability programs on the cocoa farmers' welfare (productivity, income, and food security status of cocoa farmers)?
4. What are the challenges and barriers faced by cocoa farmers in implementing certification and traceability programs?

Conducting this research is an important step in empirical information generation for policymakers (cocobod) as well as the processors and LBCs concerned with the promotion of certification and traceability. It would also assist the various stakeholders in designing appropriate policies and initiatives that aimed at increasing cocoa production in Ghana and promoting the welfare of the farmers. The study would help the various stakeholders of the cocoa certification and traceability program to know whether cocoa certification and traceability program achieves its aim of promoting the welfare of cocoa farmers.

2. CONCEPTUAL FRAMEWORK

Asamoah and Anang, (2013), indicated Cocoa beans are one of the most exported commodities after coffee and sugar. Among all the supply chains of the most exported commodities, the cocoa supply chain has been driven by the cocoa certification program, in recent years. Cocoa certification has become a vital asset in cocoa production which ensures that cocoa farmers are well integrated into the cocoa value chain (Griek et al. 2010). This seriously outlines the roles and responsibilities of farmers in manufacturing the cocoa final product. This study was driven

by the concept of improving cocoa farmers' welfare through supply chain intervention where cocoa certification was found to be one of the key interventions that aim to improve cocoa farmers' welfare (Iddrisu et al. 2020). In as much as the cocoa certification was conceptualized to improve the standard of living of farmers, the cocoa certification has experienced low participation by cocoa farmers (Ollendorf et al 2023). This called for the need to investigate the perception of farmers toward the certification program as well as the impact of the program on the farmer's welfare. The scope of the impact of certification on farmers' welfare in this research was limited to farmers' cocoa yield, cocoa income, and the food security status of cocoa farmers. The study also took a step further to investigate factors that influence cocoa farmers to participate in the certification program.

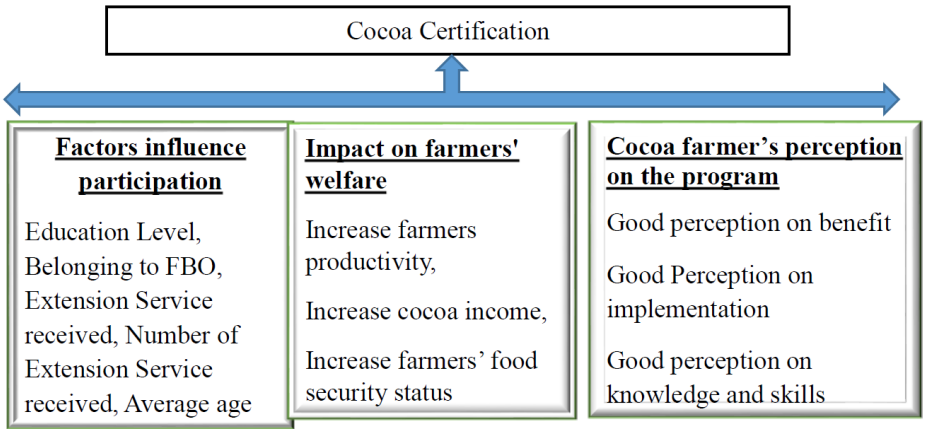

Figure 1: Conceptual Framework

The conceptual framework of this study is presented in the figure 2. The study revealed that on average cocoa farmers have a good perception of the cocoa certification in terms of its implementation, benefits, knowledge, and skills. It was also revealed that participation in cocoa certification by cocoa farmers is influenced by education Level, belonging to FBO, extension service received, number of extension services received, and the average age of the cocoa farm. These factors could be influenced by the various stakeholders in the cocoa supply chain to increase cocoa farmers' participation in the cocoa certification program. The impact of certification on cocoa farmers' welfare was also identified to increase farmers' productivity, increase cocoa income, and increase farmers' food security status.

2.1. Study Area

The study was conducted in the Effiduase cocoa district which was selected on purpose since it is one of the key cocoa-growing areas in the Ashanti region of Ghana and one of the few districts in the region within which the cocoa certification and traceability is implemented. Ashanti region is considered to be one of the top five cocoa-producing regions in Ghana (Kongor et al. 2019). The district has Effiduase as its district capital and it is located in the North East part of the region. The district lies approximately between latitude 6°45″-7°32″North and longitude 0°22″West. Sekyere East shares boundaries with four districts; North-East with Sekyere-Afram plains district, Sekyere South to the West, Asante Akim North to the South-East and Ejisu-Juabeng to the South-West. The district covers an estimated land area of about 730.5 km2 and has forty-one settlements of varying sizes. The DMTDP 2006-2009 shows that the population composition of males and females is 50.7% and 49.3% respectively, with an estimated district population of 85,365 in 2008. The total number of males to females in the population is 39,349 and 38,264 respectively. Over 50% of the district's population lives in the twin Town Councils of Effiduasi

and Asokore with a combined total population of 43,326(56%). The average household size is five. The major farming systems in the district are mixed farming or cropping and mono-cropping (Plantation crops). The main food crops cultivated in the districts are plantain, cocoyam, cassava, maize, legumes and vegetables, cash crops oil palm, cocoa, and citrus. The main economic activities in the districts are farming and trading in the farming activities.

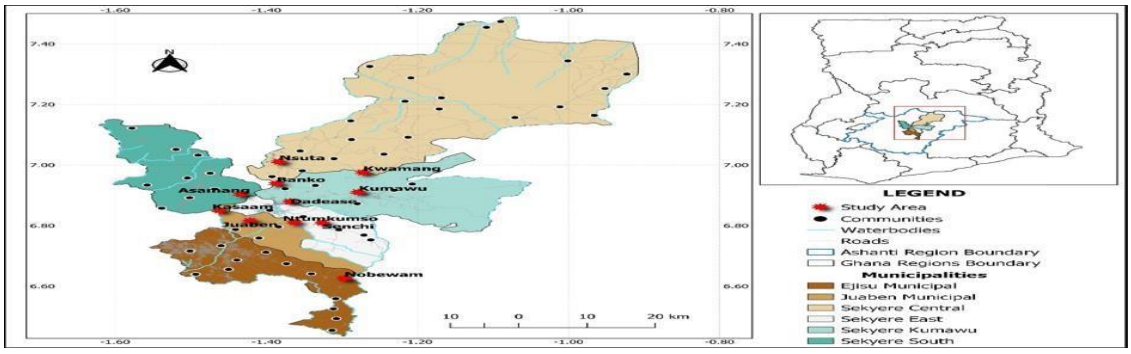

Figure 2: Map of the study area

According to the Cocoa Health and Extension Division Effiduase branch, there are 21 operational areas; however, 11 operational areas with a population of 8825 cocoa farmers were selected. A sample size of 383 was used for this study and it was determined with the help of Yamane's (1967) formulae, which are mathematically presented as:

$$\text{Sample size} = \frac{N}{1+N(a)^5}$$

Where,

N = Population (8825), the total number of cocoa farmers in the Effiduase cocoa district.
a = margin of error. (0.05 or 5%)

However, after the data cleaning, 3 questionnaires or responses did not qualify and this made the actual number of the questionnaires or sample to be 380 farmers

A multi-stage sampling approach was used to select the 383 cocoa farmers for the study.
Stage 1 Eleven operational areas were selected from the district based on the total number of cocoa farmers in the various areas. The operational areas were *clustered into two groups* (*participant zone and non-participant zone*).

Stage 2: *A quota sampling technique* was used to select the number of farmers from the various areas. Quota sampling techniques were used to get a fair representation of the farmers from various communities. The number of farmers was selected using their proportional representation in the total population. The number was computed by:

$$\frac{number\ of\ farmerrs\ in\ the\ area}{total\ number\ of\ farmers\ in\ selected\ the\ areas} \times sample\ size$$

Stage 3: *A simple random sampling technique* was adopted to select individual farmers from each of the selected Areas based on the farmers' list obtained from the District CHED Office. The primary data was collected using a standardized structured questionnaire. Both open and closed-ended questions were used to gather information from the various cocoa farmers in the Effiduase

Cocoa District. An interview method of data collection was conducted through a faceto-face meeting with the cocoa farmers. The instrument was first pre-tested in one of the communities before the main field survey. All interviews were conducted in the local Akan language (Twi) to ensure effective communication between the researchers and the respondents.

2.2.Analytical Framework

2.2.1. Perception Analysis

A perception index was employed to assess farmers' perceptions of cocoa traceability and certification. Perception statements were coded using a 5-point Likert scale*(2=strongly Agree 1= Agree, 0=neutral; -1=Disagree -2 strongly Disagree*) to measure farmers' perception of cocoa traceability and certification and the mean scores of the ranks were computed to generate the perception index (P.I) explicitly expressed as:

$$P.I = \frac{(fsa \times 2) + (fa \times 1) + (fn \times 0) + (fd \times -1) + (fsd \times -2)}{x}$$

Where; P.I = perception index, f_{sa} = frequency of strongly agreed f_a = frequency of agreed, f_n = frequency of neutral, f_d = frequency of disagreed f_{sd} = frequency of disagreed and x= number of farmers who responded to the specific perception statement.

2.2.2. Determinants of Participation in Cocoa Traceability and Certification

The probit model is a model of statistical probability where the dependent variables are dichotomous and it can only take two variables. (Dummy variable). For instance, Yes or No, True or False. The probit model was used by Uzunoz and Akcay in 2012 in their study titled 'A Case Study of Probit Analysis of Factors Affecting Consumption of Packed and Unpacked Milk in Turkey' where the main focus of the study was to find out some of the socio-economic factors that influence the consumption packed and unpacked milk.

The probit model was used in this study to identify the factors that influence cocoa farmers to partake in the certification and traceability program rollout by license-buying companies in the study area. Participation in the cocoa certification program was the dependent variable that was assumed to be influenced by certain socio-economic characteristics of the farmers or respondents as well as factors associated with cocoa production. The socioeconomic characteristics of the respondents in addition to the factors affecting cocoa production will be the independent variables.

Empirical specification underlying the probit model is given as:

$$Y_{ij} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots \beta_n X_n + \varepsilon_i \quad \ldots\ldots(2)$$

Where:

Y_{ij} = Farmer *i*'s decision to participate (*1=if farmer participated; 0=if otherwise*).
$X1, X_2, \ldots, X_n$ are the independent variables defined in Table 3.1 β_0= Constant.
$\beta_1, \beta_2 \ldots \beta_n$ = the coefficients to be estimated.
ε_i = error term

2.2.3. Impact of Cocoa Traceability and Certification on Farmers' Welfare (Cocoa Productivity and Food Security.)

Propensity score matching was used to analyze the impact of certification and traceability programs on cocoa farmers' welfare (those who participated and those who did not participate). The welfare indicators for this study were cocoa yield (Kg/acre), income from cocoa production in Ghana cedes (GHc) and household food security which was measured using the Household Food Insecurity Access Scale (HFIAS). The cocoa income was estimated by multiplying the yield obtained from cocoa production by the prevailing cocoa price per bag (64 Kg). The yield of participant farmers was also multiplied by their premium amount per bag (64 Kg). The HFIAS score was also estimated for both the control and the treated groups. The USAID HFIAS standard approach for accessing households' food security status was employed in this study as a proxy measure of the food security status of respondents. Respondents were asked nine (9) universal questions bordering on the severity of the occurrence of food insecurity conditions in the last 30 days before the data collation. The responses to the nine universal questions bordering on the severity of occurrence of food insecurity conditions were no, rarely (once or twice in the past four weeks), sometimes (three to ten times in the past four weeks, often (more than ten times in the past four weeks).

The tabular approach would be used; p(Z) = Pr {D = 1 | Z} = E {D | Z} D = {0,1},.

Z is a vector of not participating in traceability and certification.

$$\boldsymbol{\delta} = \boldsymbol{E}\{\boldsymbol{Y\_i}\hat{}\boldsymbol{1} - \boldsymbol{Y\_i}\hat{}\boldsymbol{0} \mid \boldsymbol{D\_i} = \boldsymbol{1}\} = \boldsymbol{E}\{\boldsymbol{E}\{\boldsymbol{Y\_i}\hat{}\boldsymbol{1} \mid \boldsymbol{D\_i} = \boldsymbol{1}, \boldsymbol{p}(\boldsymbol{Z\_i}) \} - \boldsymbol{E}\{\boldsymbol{Y\_i}\hat{}\boldsymbol{0} \mid \boldsymbol{D\_i} = \boldsymbol{0}, \boldsymbol{p}(\boldsymbol{Z\_i})\} \mid \boldsymbol{D\_i} = \boldsymbol{1}\}, \quad \boldsymbol{ATT} = \boldsymbol{\delta} \qquad (\text{)}$$

Where p(Z) refers to the propensity score and $Y\_i\hat{}1$ and $Y\_i\hat{}0$ are the potential outcomes

2.2.4. Constraints Analysis

Kendall's coefficient of concordance was used to rank the impact or effect of different factors as indicated by the respondent. As the purpose of this study, the list of constraints that are associated with cocoa production was made available for the respondent to rank how those constraints affect their cocoa production. The challenges were ranked based on assigned numerals in order of severity using Kendall's coefficient of concordance (w).

The formula is given as;

$$W = \frac{12[\sum T^2 - \frac{(\sum T)^2}{n}]}{nm^2\,(n^2-1)}$$

Where: T =Sum of ranks for factors being ranked m= number of respondents
n Number of factors being ranked

2.3. Results and Discussion

2.3.1. Socio-Economic Characteristics of the Cocoa Farmers

The distribution of gender of the cocoa farmer appears to have more males than females with a mean of 0.31. The mean indicated that about 68.6% of the cocoa farmers are male and 31.4% are female which means that cocoa production is a male dominating sector. However, the gender mean for the participants in the cocoa certification and traceability was 0.43 and that of the nonparticipants was 0.21(Table 1) which indicates that about 67% and 79% of the participants and non-participants respectively were male. This could be attributed to the fact that most of the cocoa farms for the couple are assumed to be owned by the husband because most of the cocoa farming activities are managed by the man (Hill et al. 2014). Moreover, gender diversity and women empowerment aspects of the cocoa certification program are reflected in the gender distribution of the cocoa farmers who are participants of the program, making participants farmers have more females than non-participants. With the marital status, the result shows that most of the cocoa farmers are married with 83.4% (Table 1). This means that the farmers would get additional hands to assist them in their cocoa production. It was also revealed that about 98% and 70% of the participants and non-participants respectively were married.

Also, the average age of the respondent came out to be about 50 years with minimum age of 24 years and maximum age of 85 years. This kind of finding is not new to Ghana's agricultural sector because Aidoo et al. (2015) indicated in their study that most of the cocoa farmers are in their old age, which does not speak well about the future of Ghana's agriculture. This means that most of the youth in Ghana are not interested in farming which should be a topic of national concern. With the education level of the farmers, the mean of the respondent's education level is 1.16. This means that the education level of the farmers is skewed toward basic education level, however, the education level of the majority of the farmers is basic education (35.4%), followed by no formal education (30.3%), secondary education (21.9%) and tertiary education (12.4%). This means that the majority of the farmers, about 70% have experienced formal education, though the education level is low it is still good news for Ghana's cocoa industry.

Table 1: Socio-economic characteristics of the cocoa farmers

Variables	Mean	Std. Deviation
Participant in Cocoa Certification and traceability	.52	.500
Gender	.31	.465
Age in years	50.80	11.499
Marital Status	1.07	.594
Level Education	1.42	1.191
Other Occupation aside from cocoa	.39	.489
Household size	10.08	6.166
Years in Cocoa Farming	17.40	8.629
Land ownership	.48	.886
Access to credit	.88	.330
if yes, where (Credit Access)	1.56	.586
Belong to FBO	.12	.321
Size of cocoa farm	8.579	5.771

Variables	Mean	Std. Deviation
Average Age of farm	15.20	7.134
Employ Add. Hands	.69	.461
if yes, how much cost (Add. Labour)	2897.47	2781.424
fertilizer type use	1.70	.475
days used to ferment cocoa	6.08	.735
Number of times applying disease control	3.71	1.858
method of cocoa cultivation	.70	.931
Received extension service	.05	.219
how many times (Extension Service)	3.49	2.684
use credit cocoa last season	.87	.342
Heard about Cocoa Certification and traceability.	.09	.286
if, yes where	3.35	1.524
How long Heard about Cocoa Certification and traceability	4.81	1.990
If No, why (non-participant)	2.74	1.367
Bags harvested last season	21.85	16.243

For the other occupation or livelihood activities that the farmers do aside from cocoa production, the analysis reveals that the majority of farmers 60.9% engage in other occupations aside from cocoa production. This finding is in disagreement with Bannor et al, (2019) which stated that the majority (54.2%) of cocoa farmers only depend on cocoa farming for their livelihood. The household size of the respondent ranges from 1 to 29 with a mean of 10 people. This means that cocoa farmers have more dependents and as much as it might be good news when it comes to getting additional hands to help them with the farming activities, for farmers to ensure the food security status of their household might be difficult because they have more mouths to feed them. It was also revealed that on average the cocoa farmers in the study area have been in cocoa farming for about 17 years with a minimum cocoa farming experience of 2 years and a maximum of 61 years. For the land tenure system in the study area for cocoa production, the majority (68.6%) of the farmers acquired their land through inheritance/gift, followed by purchase, caretaker, leasing, and renting in order. In terms of credit access, the majority of the farmers indicated that they do not have access to credit with 87.6% of the farmers. However, those who indicated that they have access to credit highlighted banks and farmer-based organizations as their main sources of credit. The result also shows that about 88.4% of the cocoa farmers in the study area belong to farmersbased organizations (FBOs).

The average cocoa farm size of the cocoa farmers in the study area is about 8 acres with a minimum of about 1.5 acres and a maximum of 41 acres. Moreover, the minimum age of the farmers' farm in the study area is 4, a maximum of 41 years, and an average age of about 15 years. The average number of cocoa bags of cocoa farmers in the study area, harvested last cocoa season is 21.86 bags with a minimum of 2 bags and a maximum of 150 bags. The result also shows that few farmers about 30% of the respondents indicated that aside from their household, they employ additional hands in their cocoa production. This means that the farmers can reduce labour costs in their cocoa production through the use of family labour which is relatively cheap. This contributes to the reason why farmers are known to have high household sizes, especially in the study area where the farmers were found to have a household size of about 10 people. In terms of the type of fertilizer used for cocoa production in the study area, the majority of the

farmers 71% indicated that they used both organic and inorganic, with 28.2% of the cocoa farmers using only inorganic fertilizer and less than 1% using only organic fertilizer. The result also shows that the average number of times the farmers apply pest and disease control chemicals is about 4 times with a minimum of 1 time and a maximum of 12 times. In the study area, the majority of cocoa farmers (62.5%) cultivated their cocoa through.

2.3.2. Perception Statements on Cocoa Certification and Traceability

The perception of the farmers on cocoa certification and traceability program were investigated with a 5-point Likert scale with strongly agree (2), agree (1), neutral (0), disagree (-1), and strongly disagree (-2). Table 4.4 gives the general perception of cocoa farmers in the Effiduase cocoa district on the cocoa certification and traceability program. The result shows that the majority of the cocoa farmers agreed with the perception statements that were presented to them with an overall mean of 1.24. The perception statements were grouped into three and they are perception on the benefit of certification, knowledge and skills, and implementation with an individual overall mean of 1.3, 1.16, and 1.18 respectively. Among all the categories of the perception statement, the perception of the benefit of cocoa certification is the one that the cocoa farmers relatively strongly agreed with the mean of 1.3.

The perception index table results indicate that cocoa farmers agree that certified cocoa farming is environmentally friendly with P. I mean 1.5. The farmers added that though certified farming has its challenges, they cannot deny the fact that it saves the environment. Though it did not get the P. I score strongly agree, however, 1.5 is above the mere agreed statement. Cocoa certification and traceability increase productivity was also agreed by the cocoa farmers with P. I score 1.34. The farmers indicated that as much as cocoa certification comes with its responsibilities, it also increases their yield and this is in agreement with (Nyamekye 2021). Cocoa certification and traceability improve the well-being of farmers and communities as a perception statement was assigned with P. I score of 1.33 for the cocoa farmers, which indicates that they agree with the statement regarding the cocoa certification and traceability program. The farmers added that aside from the premium that they received, sometimes their various communities also receive developmental projects like classroom blocks, potable water, etc. and this is consistence with Fowler et al. (2017) who stated that the communities of various certified farmers also enjoy some level of benefit from the certification and traceability program. The cocoa farmers agree that the cocoa certification and traceability program gives farmers extra income with P. I score 1.26. The farmers indicated that the mere fact that they get a premium for producing certified cocoa beans shows that they get extra income through cocoa certification. Cocoa certification and traceability guarantee quality and safe beans as a perception statement was also agreed by the farmers with P., I score 1.27. They indicated that the certification training that they receive help them to produce quality cocoa bean. Cocoa certification and traceability provide transparency in the supply chain were also agreed upon by the farmers with P. I score 1.27. The farmers indicated that the traceability program attached to the cocoa certification helps to trace the cocoa bean to the farmer level, in addition to the passbook that they used to keep records of their cocoa beans sold. Some of the farmers indicated that the traceability program ensures that the farmers get the premium that is due to them. Cocoa certification and traceability provide confidence and trust in the final consumers of a product were also agreed by the cocoa farmers with 1.32 P. I score. The farmers indicated that since both the processors and consumers can trace the cocoa bean through the traceability program attached to the cocoa certification, they would be aware of the source of the raw materials. The processors and consumers would trust the product they consumed.

The result from the perception index table indicates that the certification and traceability program is a voluntary sustainability program with P. I score 1.21. The farmers stated that though the

cocoa certification and traceability program is becoming a requirement in the cocoa industry, however, it is still a voluntary program where no farmer is forced to join. This happens to be inconsistence with the Aidoo et al. (2015), which indicated that farmers perceive cocoa certification and traceability programs as an initiative that they are being forced to participate in. The certification and traceability program are well publicized as a perception statement was scored by the cocoa farmers with P. I of 0.9, which is below 1.00 (agree). Though this score is closer to the "agreed score" (1.00), however, this clearly shows that farmers in Effiduase cocoa districts do not completely agree that the certification and traceability program is well publicized. This is consistence with Ansah et al. (2020) which indicated that smallholder cocoa farmers are inadequately informed about the certification and traceability programs. The cocoa farmers also agree to the fact certification and traceability program is against child labour and forced labour with P. I scored 1.28 and this is in line with (Islam 2015) which stated that cocoa certification and traceability were introduced to ensure that cocoa production is devoid of child labour, and forced labour. Certification and traceability program are a new normal in the cocoa industry was also agreed with by the cocoa farmers with P. I scored 1.19, whilst the cocoa certification and traceability program contribute to sustainable business growth and community development scored 1.23 as a perception index (P. I).

Table 2; Perception Statements on Cocoa Certification and Traceability.

PERCEPTION STATEMENTS.	**Strongly Agree (2) (%)**	**Agree (1) (%)**	**Neutral (0) (%)**	**Disagree (-1) (%)**	**Strongly Disagree (-2) (%)**	**Mean.**
Perception Statement on Benefits.						
Certified cocoa farming is environmentally friendly.	242(70.97)	52(15.25)	29(8.50)	14(4.11)	4(1.17)	1.5
Cocoa certification and traceability increase productivity	209(61.29)	71(20.82)	38(11.14)	17(4.99)	6(1.76)	1.34
Cocoa certification and traceability improve the well-being of farmers and communities	213(62.46)	65(19.06)	34(9.97)	21(6.16)	8(2.35)	1.33
Cocoa certification and traceability give farmers extra income	192(56.30)	80(23.46)	40(11.73)	22(6.45)	7(2.05)	1.26
Cocoa certification and traceability guarantee quality and safe beans.	199(58.36)	74(21.7)	40(11.73)	17(4.99)	11(3.23)	1.27
Cocoa certification and traceability provide transparency in the supply chain	185(54.25)	97(28.45)	39(11.44)	13(3.81)	7(2.05)	1.29
Cocoa certification and traceability provides confidence and trust in the processors and final consumers of a product	210(61.58)	71(20.82)	29(8.50)	22(6.45)	9(2.64)	1.32
Mean						**1.3**
Perception Statement on Knowledge and Skills						
Certification and traceability are a voluntary sustainability program	164(48.09)	112(32.84)	43(12.61)	16(4.69)	6(1.79)	1.21
The certification and traceability program are well-publicized	138(40.47)	93(27.27)	57(16.72)	44(12.64)	9(2.64)	0.9

Certification and traceability program is against child labour and forced labour,	210(61.58)	57(16.72)	44(12.90)	19(5.57)	11(3.23)	1.28
Certification and traceability program is the new normal in the cocoa industry	159(46.63)	114(33.43)	48(14.08)	14(4.11)	6(1.76)	1.19
Certification and traceability programs contribute to sustainable business growth and community development	184(53.96)	91(26.69)	39(11.44)	16(4.69	11(3.23)	1.23
Mean						**1.16**
Perception Statement on Implementation						
Certification and traceability programs need the collective effort of actors to ensure success	151(44.28)	111(32.55)	55(16.13)	20(5.87)	4(1.17)	1.13
The cocoa certification and traceability program is financed by manufacturers and consumers	141(41.35)	101(29.62)	53(15.54)	31(9.09)	15(4.40)	0.94
The cocoa certification and traceability program involves adhering to standards.	192(56.30)	100(29.33)	24(7.04)	19(5.57)	6(1.76)	1.33
The certified farmers have to undergo certification and traceability training	189(55.43)	94(27.57)	36(10.56)	15(4.40)	7(2.05)	1.29
Certification and traceability programs promote the safe, effective, and efficient use of agrochemicals	184(53.96)	91(26.69)	40(11.73)	16(4.69)	10(2.93)	1.24
The certified farmers have to sell the produce in the certified market	176(51.61)	97(28.45)	40(11.73)	15(4.40)	13(3.81)	1.19
Mean						1.18
Overall Mean						**1.24**

The perception table also shows that cocoa farmers agree with the fact that certification and traceability programs need the collective effort of actors to ensure success with P. I score 1.13. The farmers indicated that as much as they have a role to play by adhering to the certification standards, the LBC also has a role to play by paying the right premium and buying their certified beans. The cocoa certification and traceability program is financed by manufacturers and consumers was also agreed upon by the cocoa farmers with P. I scored 0.94, which is closer to the "agreed score" (1.00). This means that cocoa farmers are not fully aware that the certification and traceability program is financed by the manufacturers and consumers. The cocoa certification and traceability program involved adhering to standards was also scored with an I. of 1.33. The farmers added that adhering to standards is one of the pillars of certification. The certified farmers have to undergo certification and traceability training had a P. I scored 1.29, which means that the farmers agreed to the statement. Certification and traceability programs promote the safe, effective, and efficient use of agrochemicals had a 1.24 as the P. I score. The farmers added that they do receive training on the best ways of using and applying chemicals on their farms. The certified farmers have to sell the produce in the certified market was also agreed upon by the farmers with P. I score 1.19. Farmers added that sometimes, due to the financial constraints of the certified purchasing clerks, they have to sell their cocoa beans in the conventional market.

2.3.3. Factors Influencing Participation of Cocoa Farmers in the Cocoa Certification Program

Table 3 presents the result from the probit analysis that was used in estimating the factors that influence the participation of farmers in the cocoa certification program. The pseudo R^2 value of 0.7054 (70.54%) was obtained from the empirical result on factors that influences the cocoa farmers to participate in a cocoa certification program, indicating that this model better fits the outcome data. Though a pseudo-R-squared could be interpreted correctly when compared to another pseudo-R-squared of the same type, on the same data, predicting the same outcome. However, a higher pseudo-R-squared value is preferable. Table 4.45 shows the empirical results for the probit model, where the coefficient, z-value estimates, standard error, and probability values of the various variables.

The result from Table 3 shows that the number of extensions received per year is significant at 1%, and education level, belonging to farmer-based organizations, extension visits are significant at 5%, whilst the age of the cocoa farm is significant at 10%.

From the coefficient, there is a positive relationship between the age of the cocoa farmer and the cocoa farmer's participation in the cocoa certification. This means that a unit increase in the years of cocoa farm increases the possibility of the farmer of such cocoa farm participation in the cocoa certification by 0.0384, that is the age of a cocoa tree or farm is one of the key factors for a cocoa farm to start fruiting (Jagoret et al. 2018). In addition, certification program mostly focuses on the farmers whose farm has started production because the premium is paid based on the number of cocoa bags supplied by farmers.

Table 3 Factors influencing farmers' participation in cocoa traceability and certification.

Participation in Cocoa Certification Traceability	Coefficient	Std. err.	z	P>z
Gender	.2805367	.4626555	0.61	0.544
Age of Farmers	.0157838	.0312368	0.51	0.613
Marital Status	.3139583	.2597395	1.21	0.227
Level Education	.741015**	.3664202	2.02	0.043
Household size	.0969742	.0825333	1.17	0.240
Years in Cocoa Farming	.0010875	.0385273	0.03	0.977
Landownership	.1150811	.1883838	0.61	0.541
Belongs to FBO	1.236981**	.5965101	2.07	0.038
Size of cocoa farm	.022416	.042218	0.53	0.595
Average Age of farm	.0729513*	.0384211	1.90	0.058
Received extension service	3.812754***	1.24205	3.07	0.002
Number times for Extension Service	.1477464**	.0594698	2.48	0.013
Awareness of cocoa traceability	.0072273	.1302041	0.06	0.956
cons	6.70796	2.284084	2.94	0.003

LR chi2(13)=71.28, Prob > chi2=0.0000, Pseudo R-likelihood = 30.90484

***significant at 1%, **significant at 5% and *significant at 10%

The education level is also found to be positively proportional to the possibility of a cocoa farmer participating in the cocoa certification. This also means the increase in the number of years by cocoa farmers increases the possibility of the farmer participating in the cocoa certification by 0.3664. The cocoa certification is known to come with a lot of standards and recording keeping which require some level of literacy. This sometimes make it a requirement for farmers who participate in the cocoa certification to have some level of literacy or have some education background (Quayson, 2020), though in general Ghanaian farmers are known to have a low educational background. However, the cocoa farmers who participate in the cocoa certification are likely to have a restively higher educational background. Belonging to the farmer-based organization is also known to influence farmers' participation in the cocoa certification that is a unit increase in the farmers' possibility to join a farmer-based organization increases the possibility of the farmers' participation in the cocoa certification program by 0.5965 and it was significant at 5%. This is consistence with Giagnocavo et al. (2017) who indicated that in most cases, the cocoa certification arrangement is between the cooperative societies and the LBCs. This make the "belonging to cooperative society" in most times, a requirement for participating in the certification and traceability schemes. The extension service received or extension visit was also found to influence the cocoa farmers' participation in the cocoa certification. Extensive service is noted to promote the welfare of the farmers by giving the farmers education on good agriculture practices to ensure the safety of the farmers as well as increase their production. With this, the extension agent would also encourage the farmers to join cocoa certification if it is available since the extension service and cocoa certification have some kind of common goal to promote the welfare of the farmers. A unit increase in the possibility of a farmer receiving an extension service increases the possibility of a cocoa farmer participating in the cocoa certification by 1.242 at a significant at 1%. In addition, the number of times a farmer received extensive visits was found to be significant at 5% which means that a unit increase in the number of times farmers received extension service or visits influenced the farmers' participation in the cocoa certification program.

2.3.4. Impact of Cocoa Certification and Traceability Programs on Food Security Status

The propensity score matching analysis for the impact of cocoa certification and traceability on cocoa farmers' food security status is presented in Table 4.7. TheHFIAS score for food security status is grouped into four categories which are food secure (0-4), mildly food insecure (5-7), moderately food insecure (8-10), and severely food insecure (11-27) (Iddrisu et al. 2020).

Table 4. Impact of cocoa certification and traceability programs on food security status

Variable Sample	Treated	Controls	Difference	S.E.	T-stat
Hfiasscore Unmatched	6.63	10.83	4.20	2.02	2.08
ATT	3.33	7.04	3.70	1.94	1.91*

LR chi2(11) = 51.74, Prob > chi2 = 0.0000, Pseudo R2 = 0.5996, Log likelihood = 17.277372 ***significant at 1%, **significant at 5% and *significant at 10% The propensity score results for both the unmatched and matched were statistically significant, however, the score for matched was more significant than the unmatched. According to the HFIAS score category of the food security status, the propensity score obtained at unmatched for participants of the cocoa certification and traceability program is 6.63 (mildly food insure) indicating that the participants of the program are more food secure than the non-participants of the program which obtained propensity score of 10.83 (severely food insure). The propensity score after matching even placed the participant of the cocoa certification and traceability program at a higher food

security status with an average HFIAS score of 3.33 which moved the participant's food security status from mildly food insecure to the category of food secure. The non-participants of the cocoa certification and traceability program also shift in the food security status after matching. The non-participant also obtained an average HFIAS score of 7.04 after matching, which also moved their food security status from severely food insecure to mildly food insecure. Based on the 1996 World Food Summit, food security is defined as when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Aliaga et al. 2014). This means that the participants of the certification and traceability program hardly express concern about not possessing the means to access sufficient food. Whilst the non-participant farmers are known to consume their favourite meal, however, when it comes to the acquisition of such meal, they sometimes face difficulties which force them to eat the food that they do not desire to eat. This is in agreement with section 2.3.6 which indicates that cocoa certification and traceability programs increase farmers' yields which are in direct relation to an increment in farmers' income

2.3.5. Impact of Cocoa Certification and Traceability on Farmers' Productivity and Income

The propensity score matching analysis for the impact of cocoa certification and traceability on cocoa farmers' productivity is presented in Table 5, and it shows the average treated effect of the cocoa certification and traceability on the treated to be 4.79 which is significant at 10% (1.73) after matching. This means that the cocoa farmer's participation in the cocoa certification and traceability increases farmers' yield by 4.79 bags per hectare.

Table 5 Impact of Cocoa certification and traceability on farmers' Productivity

Variable Sample	Treated	Controls	Difference	S.E.	T-stat
Bags harvested Unmatched	9.785	7.841	1.944	4.09471	0.47
ATT	9.515	4.720	4.794	6.22761	1.73*

LR chi2(11) = 53.52**,** Prob > chi2 = 0.0000, Pseudo R2 = 0.4021,

Log-likelihood = -39.78517 ***significant at 1%, **significant at 5% and *significant at 10% Though the propensity score result shows no significant difference between participation in certification and non-participation before matching after matching gives a significant difference of 4.79 bags of cocoa per hectare. This indicates that the difference of 1.94 bags which is in favour of cocoa certification farmers against the non-participants in the cocoa certification before matching was not statistically significant (Table 5). The result estimating the impact of cocoa certification on farmers' income by propensity score matching was also presented in Table 4.8.1. There is a positive relationship between productivity and income. This means that an increase in productivity increases income, especially in the cocoa industry that are known for less positive harvest loss coupled with a secure market. From Table 6, the result shows a significant difference between the cocoa certification participant and non-participant after matching which was significant at 5% (unlike the productivity which was significant at 10%), with a difference of GHC 3835.2. The difference in the significance between productivity and income could be ascribed to the fact that the certification farmers earn extra income in the form of premium which is also mapped to their productivity or yield which the non-participant or conventional farmers do not have any means to get it. However, the result before matching was not statistically significant like the productivity. This finding is in agreement with Iddrisu et al. (2020) which indicated that cocoa certification has an impact on cocoa farmers' welfare in terms of productivity and income. This means that participation in cocoa certification and traceability program increase farmers'

yield which transcends into an increase in their income as a result of the sale of extra bags of cocoa bean obtained and the premium.

Table 6; Impact of Cocoa certification and traceability on farmers' Income.

Variable Sample	Treated	Controls	Difference	S.E.	T-stat
Income Unmatched	8092.195	6272.8	1555.2	3364.634	0.34
ATT	7868.905	3776	3835.2	2035.222	2.04**

LR chi2(11) = 44.93, Prob > chi2 = 0.0000 , Pseudo R2 = 0.5594,
Log-likelihood = 17.690281 ***significant at 1%, **significant at 5% and *significant at 10%

2.3.6. Constrains of Cocoa Farmers

This subsection discusses constraints that cocoa farmers face in their cocoa production concerning the cocoa certification program. The test statistics indicate the correlation between the data collected from the respondents. The value of Kendall's $W^a = 0.6228$ portrays a strong positive relationship between the data collected from the respondents. This means that the data collected from the respondents agree with one another. This will help the users of this study to know the most severe and least severe constraints that the farmers face in their cocoa production. The constraints were presented to farmers to rank in order of severity irrespective of the farmers' cocoa certification status (participant and non-participant). Farmers were presented with 16 constraints in four categories (Economic and Financial, Agronomic challenge, weather and climate, and knowledge and skills) to rank them in order of severity to the farmers. The first ten constraints are discussed in order of severity to farmers and the rest of the six constraints were not discussed. Those constraints are perceived to have less influence on the farmers' cocoa production and their participation in the cocoa certification, however, to get the overview of the remaining six constrains, the table 4.9 gives their position in terms of how severe they are to the farmers according to the ranking. On average, the Agronomic challenge was ranked the most severe constraint, followed by economic and financial constraints, then knowledge and skills constraints, and lastly weather and land challenges.

Table 7: Constraints of the cocoa farmers.

S/N	Constraints	Categories of challenges	Mean	Position
1	Low premium amount and incentives.	Economic and Financial	4.06	1st
2	Delay in premium payment	Economic and Financial	5.52	2nd
3	Low access to improved farming technologies	Agronomic challenge	6.29	3rd
4	Record keeping	Knowledge and Skills	7.19	4th
5	Pest and Diseases infestation	Agronomic challenge	7.34	5th
6	Restrictions on agro-chemicals	Agronomic challenge	7.4	6th
7	Low yield from the cocoa farm	Agronomic challenge	7.57	7th
8	The unwillingness of LBCs to pay a premium	Economic and Financial	7.68	8th
9	Time spent on training	Agronomic challenge	8.97	9th
10	Restrictions on the location of farms	Weather and Land	9.93	10th
11	Competition on cocoa lands for other	Weather and Land	9.93	11th
12	Awareness of certification standards	Knowledge and Skills	9.98	12th

13	Availability of certification scheme	Knowledge and Skills	10.12	13th
14	Cost of adhering to certification standards	Economic and Financial	10.36	14th
15	Litigations on land	Weather and Land	10.5	15th
16	Lack of certified market	Economic and Financial	13.16	15th

Kendall's $\boldsymbol{W^a}$ = 0.6228, Chi-Square = 1168.091, df = 15, Asymp. Sig. = 0.000

The result of the ranking shows that low premium amount and incentives constraint is the constraint that was ranked first. This shows that among all the constraints that were presented to the farmers, cocoa farmers see the low premium amount and incentive as the most pressing constraint they face in cocoa production and cocoa certification and traceability program participation. This in the long run could affect the participation in the certification and traceability program if the cocoa farmers realised that the program benefits do not match the effort and resources they invested in the program. The second most pressing constraint for cocoa farmers is the delay in the payment of premiums to farmers. In as much as the farmers indicated a low premium amount and incentive as their most pressing constraint, they also added that the payment of the premium was also delayed. This could be a key discouraging factor for cocoa farmers' participation in the cocoa certification and traceability program. Low access to improved farming technologies was also ranked as the third most pressing constraint by the farmers. They indicated that though they have been some technological development (such as tools for pruning, weeding, etc,) in cocoa, however, most cocoa harvesting and post-harvest activities are still done manually. The cocoa farmers stated one of the post-harvest activities that when it is mechanized, they would be very grateful for is the breaking of the cocoa pod and the removal of the beans from the pod. The fourth most pressing constraint was noted to be recording keeping. The farmers agree that recording keeping is important for cocoa certification and cocoa production in general, however, the farmers indicated that recording keeping is also one of the most pressing constraints, of which the farmers ranked it as the fourth most pressing constraint. Some of the farmers stated that their education level is low and this constrains them from keeping proper records about their cocoa production. Those who indicated that they can do the recording keeping also stated that, in most cases, they are constrained with time. Pest and disease constraints were also ranked as fifth most pressing constraint in their cocoa production. The farmers stated that though other constraints are equally important, however, this constraint affects their yield, hence their productivity and income. The restriction on the use of some agrochemicals was also indicated by the cocoa farmers as their sixth most pressing. This constraint was stressed by most of the certification farmers who stated that the use of approved agrochemicals is one of the key pillars of the certification program. The cocoa farmer added that some of the agrochemicals that they are being restricted from using are mostly cheap and also give quick results, and this serves as a great barrier to the use of agrochemicals for their cocoa production. The seventh constraint of the cocoa farmers is the low yield from the cocoa farm. The farmers stated that low yield might be influenced by several factors, however, it is a burden to them because it affects the status of the viability of their cocoa farms. The unwillingness of LBCs to pay a premium was also indicated to be the eighth constraint of the cocoa farmers. This shows that as the farmers face a problem of the low premium amount and delay in payment, they also have a problem of premium unpaid. This discourages cocoa farmers from participating in the cocoa certification program. The farmers indicated time spent on training as the ninth constraint. The farmers stated that some time on training could do great good to their farm but since some of the certification training is mandatory, they have to quit their farming activities and partake in the training, and in most cases, it affects their farming schedules. Restrictions on the location of farms were also indicated as the tenth constraint the cocoa farmers face, especially most of the non-participants of the certification program, cocoa farmers who have their farms in the forest zone are prevented from participating in the certification program.

3. CONCLUSION AND RECOMMENDATION

The focus of the study was on the perceptions of the cocoa farmers on the cocoa certification and traceability program, the impacts of cocoa certification on the farmers' welfare (productivity, income and food security) and the factors that influence farmers to participate in the cocoa certification and traceability program. In all, 383 farmers were sampled for the study, however, 380 responses were used for this study because 3 responses did not qualify to be used for the study after data cleaning.

The perception index was used to gather the perceptions of farmers through the Likert scale where the farmers were to rank their agreement with some statement on cocoa certification, from -2 to 2. Though none of the statements had a means score of 2 which means that none of the statements were strongly agreed by the farmers in general, however, majority of the statements had a mean score greater than one and this means that the farmers agreed with those statements. The perception statement on benefit of the certification had a mean score of 1.3, and that of knowledge and skills was 1.16. The perception statement on implementation also had a mean score of 1.8. However, few statements get a mean score of less than one, which means that farmers were not in agreement with those statements. In all, none of the statements gets a mean score of negative value, which means that none of the statements was disagreed by the cocoa farmers in general.

The probit model was also used to estimate the factors that influence cocoa farmers to participate in the cocoa certification and traceability program. Among all the factors that were included in the regression analysis, education level (5%), belonging to a farmer-based organization (5%), the average age of the farm (1%), extension service received (10%), and the number of times the farmers receive extension service per year (5%) were factors that come out to be significant. The propensity score matching was used to estimate the impact of cocoa certification on the farmers' cocoa productivity and cocoa income as well as household food security. The HFIAS score was used to estimate the food security status of the farmers. It was revealed that 39% of the respondents are food secure with 46% of the certified farmers being food secure compared to 32% of the nonparticipant farmers who were food secure. 13% of the cocoa farmers also responded mildly food insecure while the percentage of the cocoa farmers that responded moderately food insecure is 14%. The analysis also revealed that about 35% of the farmers are severely food insecure. The propensity score matching for food security analysis revealed that the participants of the certification and traceability program are more food secure than the cocoa farmers who do not participate in the program. According to the HFIAS score category of the food security status, the propensity score obtained at unmatched for participants of the cocoa certification and traceability program is 6.63 (mildly food insure) indicating that the participants of the program are more food secure than the non-participants of the program which obtained propensity score of 10.83 (severely food insure). The propensity score after matching even placed the participant of the cocoa certification and traceability program at a higher food security status with an average HFIAS score of 3.33 which moved the participant's food security status from mildly food insecure to the category of food secure. The non-participant also obtained an average HFIAS score of 7.04 after matching, which also moved their food security status from severely food insecure to mildly food insecure.

The propensity score matching analysis for the impact of cocoa certification and traceability on cocoa farmers' productivity shows the average treated effect of the cocoa certification and traceability on the treated was 4.79 which is significant at 10% (1.73) before matching. This means that the cocoa farmer's participation in the cocoa certification and traceability increases farmers' yield by 4.79 bags per acre. The impact of cocoa certification and traceability on

farmers' income was statistically significant at 5% with a difference of GHC 4,160.16 in favour of participants of the cocoa certification and traceability program.

Kendall's coefficient of concordance was also used to estimate the constraints cocoa farmers face in cocoa production and participation in cocoa certification. The constraints were presented to farmers to rank in order of severity irrespective of the farmers' cocoa certification status (participant and non-participant). Farmers were presented with 16 constraints in four categories (Economic and Financial, Agronomic challenge, weather and climate, and knowledge and skills) to rank them in order of severity to the farmers. The result of the ranking shows that low premium amount and incentives constraint, delay in premium payment, low access to improved farming technologies, record keeping, pest and disease infestation, and restrictions on agro-chemicals were the first six constraints in ascending order.

Based on the key findings of this study, the following are some recommendations that were suggested concerning the subject matter of the study and also to aid in future research. The licensebuying company should try and bring more clients or manufacturers on board to enrol more farmers in the cocoa certification and traceability program. Because the cocoa certification and traceability program was found to have a significant impact on the farmers' welfare in terms of cocoa productivity and income, the number of cocoa farmers who were participants was less than the cocoa farmers that are not participants of the program. This means that many farmers are not enjoying the benefits of cocoa certification and traceability programs. However, the cocoa certification and traceability program are meant to ensure the sustainability of the cocoa production and supply chain and if few farmers are participating in the certification program, this means that the sustainability of the cocoa industry is at stake. Though Ghana Cocoa Board and Ghana Government are not involved in the cocoa certification and traceability program in Ghana, however, since they are the sole exporter of Ghana cocoa beans. They could make it a requirement for all the LBCs and the buyers (manufacturers) which ensure that the certification programs are scale up to cover almost every cocoa farmer in Ghana. This would ensure the sustainability of the Ghana cocoa industry as well as promoting the welfare of cocoa farmers in Ghana.

Concerning the challenges faced by cocoa farmers, it is recommended that, key stakeholders (Cocobod) should make improved farming technologies available for cocoa farmers to access at a subsidised price. This would go a long way to minimize most of the pressing challenges faced by cocoa farmers in the cocoa district. Again, with the issue of land ownership, the government of Ghana through the Ministry of Lands and Natural Resources should outline intervention measures to grant cocoa farmers access to agricultural lands. Also, the government should tighten the fight against illegal mining such us galamsey which competes seriously with farmers for agricultural lands. The study was conducted in off cocoa season and it is the time when most cocoa farmers do not get any income from their cocoa farming. This can attribute to the fact that majority of cocoa farmers were food insecure. However, it would be necessary for further study to investigate the food security status of cocoa farmers during cocoa season. This would help to report on the full overview of the impact of the certification and traceability program on the farmers' food security status, which would guide the formulation and implementation of appropriate interventions to improve and promote the food security status of cocoa farmers in Ghana.

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