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Research Paper

Determinants of the adoption of additional livelihoods among smallholder cocoa farmers in the Sefwi Akontombra cocoa district of Ghana

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ABSTRACT

Although the production of cocoa in Ghana sustains the economy, its quantity has not been stable in the past. This instability in the quantity of cocoa produced can be attributed to climatic conditions and other human-induced factors such as Galamsey. In the Sefwi Akontombra cocoa district, one leading cause of the reduction of cocoa is the infestation of the Cocoa Swollen Shoot Virus Disease (CSSVD). Farmers Business School has been one medium through which farmers are educated on how to make farming a business however, various factors seem to limit farmers decisions to adopt these additional livelihoods. Hence, the main objective of the study was to explore the various factors that hindered farmers' decision to adopt additional livelihoods. Employing the simple random sampling method, 410 farmers were selected for the study. A binary Logistic regression model was employed to establish relationships between Additional Livelihoods and the various factors that hinder its adoption. The study revealed that Good Agronomy Practices such as annual pruning, annual fertilizer application, and annual pollination were practiced by farmers. Regardless of this GAP, the quantity of cocoa beans produced annually per hectare has been reduced from 2017 to 2021. The study also revealed that farmers who have adopted additional livelihoods have their income level increased, food security, and general livelihood increased. Most of the farmers (70.7%) were not regular at Farmers Business School which seems to be a reason why the majority have not adopted additional livelihoods. Other factors such as environmental, socio-cultural, and economic were significant at 0.05 significant level. However, personal factors were not significant at either 0.1, 0.05, or 0.01. The study recommends that farmers should be frequent participants in Farmers Business School.

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1. INTRODUCTION

Ghana's economy depends on cocoa, which provides over 800,000 farmers with direct financial support and accounts for 2.2% of the country's agricultural sector's Gross Domestic Product (GDP) [1]. Smallholder farmers work on an average of 3 hectares of land to grow cocoa, which provides more than 67% of the household's income [2], [3]. As a result, cocoa is a crucial crop for both domestic use and the country as a whole. The yield, however, falls short of international requirements [4]. Additionally, with a poverty incidence of 42%, the average daily income per person earned by Ghanaian cocoa farmers is below the poverty line [2]. This suggests that cocoa farmers experience poverty at a higher percentage than the overall rate (19.3%) (poor per capita expenditure). Low adoption of technology is one cause of low yield resulting in low per capita income, or poverty among farmers. It has been revealed that only 10% of cocoa farmers used the full/complete set of production techniques that the Cocoa Research Institute of Ghana [5] advised to ensure a yield of roughly 1,400 kg/ha. On 5th May 2022, the Regional Minister of Western North noted with concern how cocoa production in the Western North region has whittled down from 400,000 – 150,000 metric tonnes due to climate change.

In Ghana, the Farmer Business School (FBS) was suggested as the best model for fostering farmers' entrepreneurial and market orientation (Food and Agriculture Organisation [6] German Cooperation Deutsche Zusammenarbeit [7]. The FBS was developed to encourage farmers to adopt agricultural technologies and Additional Livelihood Programs (ALPs). Additional Livelihood Programs are schemes and programs, carefully designed by stakeholders and government agencies to help a particular group of people increase their livelihood and well-being. Regarding the ALP under the FBS which is organized by the Ghana Cocoa Board and other private cocoa companies in Ghana, farmers have been taught Additional Livelihoods (ALs) such as cassava processing, snail farming, Beekeeping, Poultry, Livestock rearing, Mushroom production, soap making and other off-farm activities to boost production and reduce poverty. With the help of the FBS's adult learning strategy, farmers can learn from their own experiences and overcome obstacles on the farm. Farmers' engagement in FBS is anticipated to increase productivity and generally improve their standard of living. However, there is an empirical gap because there have been few studies on the various factors that determine Additional Livelihood adoption among cocoa farmers in Ghana. Literature has concentrated on the yield/outcome of farmers who participated in FBS. Cocoa production has decreased in the Sefwi Akontombra Cocoa District, which happens to be the epicenter of the Cocoa Swollen Shoot Disease Virus (CSSVD). This disease is one of the major challenges cocoa farmers find difficult to tackle due to its widespread. It is mostly caused by changes in climatic conditions and other factors. CSSVD, regardless of any other factors can singlehandedly reduce the number of pods a cocoa tree is expected to produce [8] Agyeman-Boaten, 2018). FBS has taught farmers to resort to additional livelihoods to reduce poverty rates among cocoa farmers. With all these interventions by the government and other stakeholders, some farmers are still reluctant to adopt these interventions. This study, therefore, seeks to explore the factors that determine additional livelihood adoption among cocoa farmers in the Sefwi Akontombra cocoa district in the western north region of Ghana.

2. RELATED WORK

According to a study by [9], technological advancement is not the primary driver of increased cocoa production, but rather the expansion of farmlands, which rendered the growth unsustainable. The Farmer Field School (FFS), among other creative technology adoption strategies, was sparked as a result of this and other factors to support and contribute to the spread of technology. However, despite the FFS-induced increase in productivity, farmers' household income remains low as a result of an inadequate market-oriented mentality. A recent study by [10] found that FBS members have superior skills, knowledge, and attitudes than non-participants in the production of cocoa. The adoption of Good Agricultural Practices (GAP) by cocoa farmers in Ghana increased primarily by 60% to 85%, according to a project status report by Deutsche Gesellschaft für Internationale Zusammenarbeit [7], while business tools were embraced at a rate of 30% to 75%. It's interesting to note that the study also stated that farmers had seen a 40% to 100% boost in production. Additionally, cocoa farmers saw improvements in household nutrition and farm income. On the other hand, according to the Ordinary Least Square (OLS) model, [11] did not discover any actual association between FBS and yield. Research has revealed that despite the numerous interventions by stakeholders to increase cocoa production, the yield has been decreasing over the past few years, rendering cocoa farmers poorer.

3. METHODOLOGY

3.1 Study Area

Sefwi-Akontombra District as shown in Figure 1 is one of the nine districts in the Western North Region, of Ghana. Akontombra falls within the rainforest zone therefore it is to record rainfall throughout the year, but current weather patterns observed are long drought periods extending to mid-April, erratic rainfall, and drying of water bodies. Despite the high amount of rainfall recorded in the region annually and the good soil suitable for cocoa production, the Sefwi Akontombra cocoa district happens to be the epicenter of Cocoa Swollen Shoot Virus Diseases (CSSVD) which has led to a reduction in cocoa production. Most of the cocoa farms within the district are undergoing rehabilitation [8].

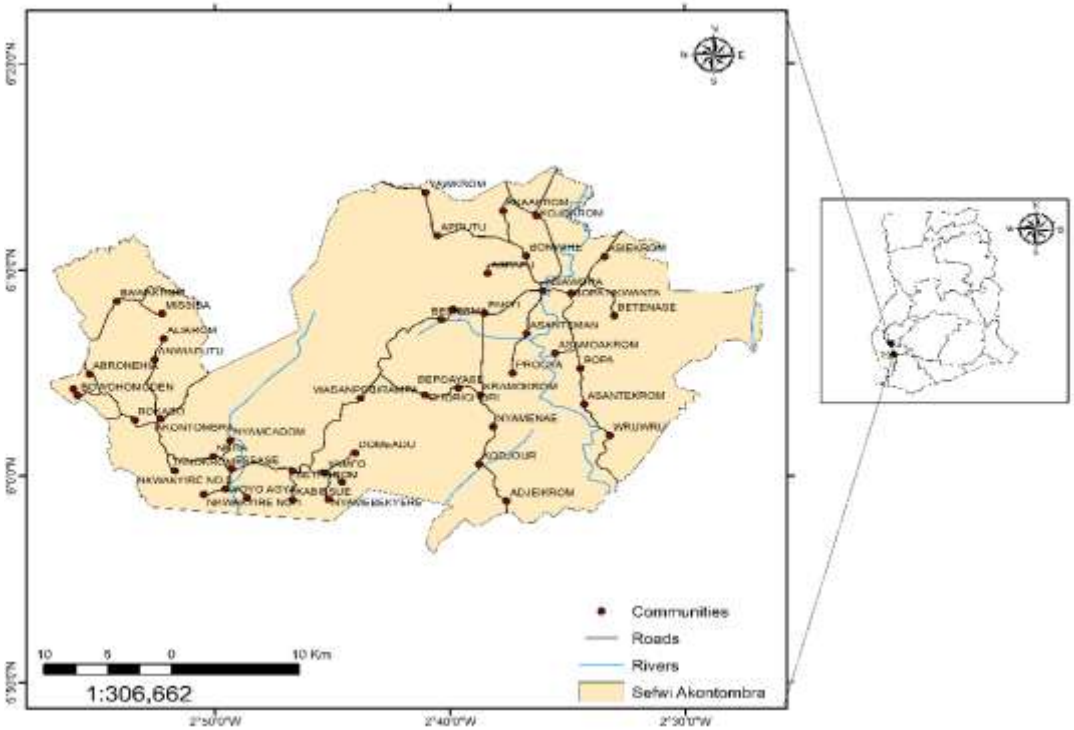


Figure 1. Study Area (Sefwi Akontombra Cocoa District)

3.2 Materials Used

The study depended on both primary and secondary data sources. Primary data was gathered on the field whereas secondary sources of data included published works, articles, TV programs, websites, and others. Quantitatively, the survey method was employed. In the sight of [12], using questionnaires provides an objective social reality that enhances accuracy and consistency in collecting data. Both closed and open-ended questions were used to gather data for the study. Questions were based on farmers' alternative livelihoods, the various factors restricting them from adopting certain alternative livelihoods, average cocoa beans produced annually as well as Good Agronomy Practices (GAP). Interview schedules were carefully structured questions for some selected individuals who knew the topic under study. observational checklists were used to examine the various Agronomy practices done by farmers as well as the various alternative livelihood programs they engage in. Focus group discussions were done in groups of 7-15 members per group. Group one consisted of males, group two, consisted of females, group three consisted of both males and females who were engaged in alternative livelihood programs and the last group catered for both males and females who were not engaged in any other livelihood program.

3.3 Methods

In this study, the mixed method research strategy which constitutes quantitative and qualitative methods was adopted. The quantitative research method provided a formal and orderly process for explanations purposely to develop, confirm, or validate relationships and develop generalizations [13]. The qualitative method, on the other hand, informed the study of the research problems, to address the meaning individuals or groups give to a particular social or human problem [14]. Therefore, the mixed method provided a better understanding of this research problem under study than using a single approach. The target population for the study were farmers who had been trained under the FBS program which was opened to all cocoa farmers. Employing the simple random sampling technique, 410 cocoa farmers were selected within the Sefwi Akontombra Cocoa district. The purposive sampling technique on the other hand was employed to select opinion leaders and other individuals who knew about the phenomena under study. 10 individuals were duly selected including the various Cocoa Extension Agents (CEAs), Technical Assistants (TAs), and Chairmen for the various cooperatives.

The Statistical Packages for Social Sciences (SPSS version 24.0) software was used to analyze quantitative data where descriptive statistics were presented in frequencies and percentages. Tables, bar charts, and pie charts were generated to represent findings from the survey. To further analyze the various factors that affect or inform a farmer's decision to adopt a particular technology, the Binary Logistic Model was employed. The Binary Logistic Model takes on dichotomous responses as shown in Eq. (1).

$$SL = \beta 0 + \beta 1\, E + \beta 2\, F + \beta 3 SC + \beta 4\, P + \varepsilon i \quad (1)$$

Where SL, which is the independent variable that represents Sustainable Livelihood, is the parameter in the regression model. Explaining the independent variables, E represents Environmental factors, F denotes Financial Accessibility, SC represents Socio-cultural factors, P represents Personal factors and epsilon is the error term that captures all other relevant variables that may influence the adoption of SLPs but were not included in the model. The result of the regression model above was estimated using SPSS version 24.0. To measure the level of internal consistency with responses, Cronbach's Alpha was employed. Recordings at various interview sections were also transcribed on paper which would be analyzed manually.

4. RESULTS AND DISCUSSION

To achieve the objective of the study, the socio-demographic background of respondents was examined. Males outnumbered females as shown in Table 1. The need for Proper farm management like frequent pruning, application of specific fertilizer, and annual pollination as shown in Table 1 were the identified required cocoa management practices that aid in large quantities of cocoa bean production [15] in the study area.

Table 1. Background Characteristics of Farmers

Demographics	Frequency	Percentage
Sex		
Male	318	80
Female	82	20
Age		
Below 20	10	2.4
20-30	70	17
31-40	130	31.7
41-50	100	24.4
51-60	85	20.7
Above 60	15	3.6
Farmers Business School Participation		
Yes	120	29.3
No	290	70.7
Level of Education		
No formal education	189	46
Basic	151	36.8
Secondary/Vocational	52	12.6
Tertiary	8	1.9
Years of Farming		
below 5 years	66	16.1
6-10 years	83	20.2
11-20 years	100	24.4
Above 21 years	151	36.8
State of Farm Ownership		
Inherited	150	36.6
Purchased	39	9.5
Contract	28	6.8
Sharecropping	183	44.6

Table 2. Farm Specifications

Farm Specifications	Yes	No
Annual Pruning		
2017	214	196
2018	312	98
2019	297	113
2020	322	88
2021	364	46
Annual Fertilizer Application		
2017	315	95
2018	348	62
2019	387	23
2020	401	9
2021	408	2
Annual Pollination		
2017	213	197
2018	167	243
2019	278	132

2020	259	151
2021	265	145

According to the FAO's (2010) definition of smallholder farmers, smallholder farmers are farmers who farm plots on 2 hectares or less and rely exclusively on family labor. Due to this, the average annual cocoa production per 2 hectares was analyzed using a graphical table. All other things being equal, taking into consideration the required agricultural practices, a hectare of cocoa farm is supposed to produce a range of 1000-2000kg of dried cocoa beans [16]. An average quantity of 1500kg [5] of dried cocoa beans is expected to be produced annually per hectare.

$$Since\ a\ bag\ of\ cocoa\ beans\ is\ 64kg;\ 1500/64 = 23.4kg \quad (2)$$

Therefore, a maximum of 46 bags of dried cocoa beans are to be produced by a maximum of 2 hectares within a year.

Based on Eq. (2), farmers were requested to provide the number of cocoa bags produced annually between the periods of 2017-2022. From Figure 1, it was revealed that the bags of cocoa produced by smallholder farmers between the said years have been decreasing at a decreasing rate and this finding is consistent with the findings of [17] which stated that there has been a fluctuation in the number of cocoa beans produced in the past years. This could amount to a lot of factors such as changes in climatic conditions, inadequate input supply and agricultural practices, inadequate extension services, the infestation of pests and diseases, access to financial opportunities, conversion of cocoa farmlands into galamsey sites, and many more [16]. Dormon, Huis, & Leeuwis, 2004) hence, the reason(s) for every farmer to adopt additional livelihoods since these factors are determined both by man and nature.

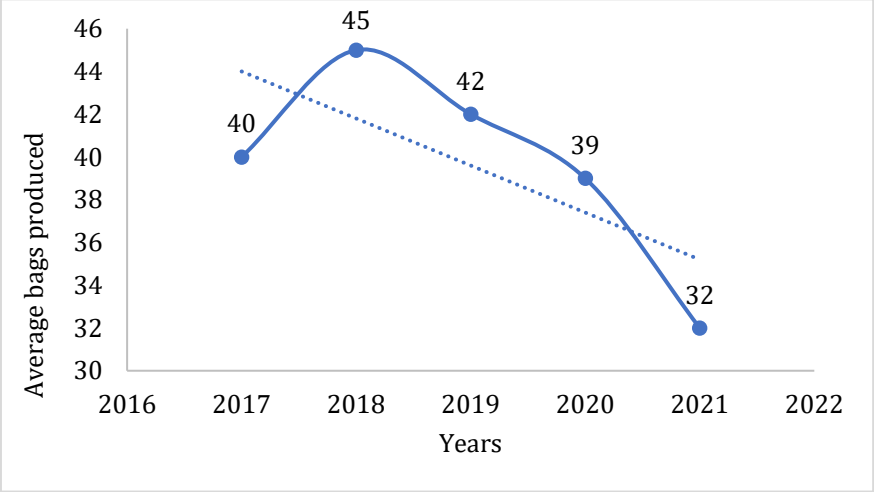


Figure 2. Average Cocoa Beans Produced Annually

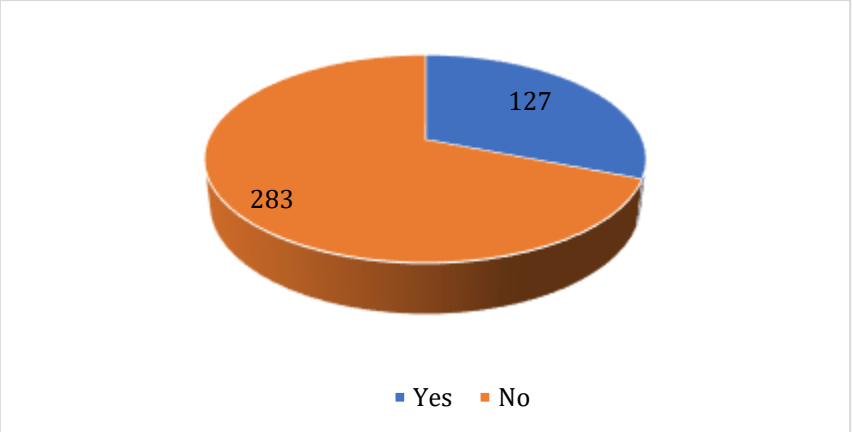


Figure 3. Additional Livelihood Adoption

Many of the respondents had not adopted Additional livelihoods at the time the data was gathered. This can be attributed to a lot of factors such as financial constraints, access to land, access to input and supplies, environmental constraints, and others [18]. On the flip side, those who had adopted additional livelihood shared some of the benefits as shown in Table 3.

Table 3. Benefits of Additional Livelihood Adoption

Benefits	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree
Purchase of inputs	80	41	5	1	0
Increase in yield	67	53	7	0	0
Asset acquisition	45	37	45	0	0
Improvement in general livelihood	90	15	22	0	0
Cronbach's Alpha Value = 0.912			N of items = 4		

Various factors influence the decision of farmers to adopt a particular technology introduced to them or not. These factors are not limited to culture, land tenure systems, land ownership, access to credit facilities, access to affordable inputs, topography, and many more [19], employing the binary logistic model which takes on dichotomous responses, the Table 4 is the result of the regression as shown in Eq. (1).

Table 4. Binary Logistic Regression Model

Factors	B	Odds	Std. Error	Sign (p)
Environmental	3.25	2.3	0.05	0.033**
Financial	2.13	1.8	0.02	0.004**
Socio-cultural	0.43	1.3	0.13	0.020**
Personal	0.13	0.4	0.01	0.220
Constant	0.21	1	0.02	0.000**
Nagelkerke R^2= 0.46 α=Dependent variable: SLs df=4 Statistically significant at 0.01*, 0.05**, 0.10***				

The unstandardized beta (B) was used to establish a linear relationship between the dependent and independent variables [20]. A positive B denotes a positive relationship between the independent and dependent variable such that, an increase in one will lead to a proportional increase in the other. To consider a variable statistically significant, the odds of the model should be more than 1, and the Sign (P value) should also be less than 0.05 [19]. Apart from Personal Factors, all factors above are statistically significant. The value of the R^2 explains the magnitude of influence that all independent variables have on the dependent variable. For example, the value of the R^2 in the above table denotes that all independent variables put together would have a 46% influence on the ALP adoption.

4.1 Discussion

Various researchers have concluded that the socio-demographic characteristics of farmers have a greater influence on their decision and willingness to adopt a particular technology introduced [18] Obeng & Ahiakpor, 2014). The background characteristics of farmers were captured and the dominating sex in the study area were males as shown in Table 1. This is common in the field of agriculture since it is strength-intensive and male-dominated (MoFA, 2014). Most of the farmers were aged between 31-40 years as shown in Table 1. Gradually, the narrative of farmers being aged (50 and above) is changing and this is close to the findings of [18]. In confirmation of the findings of Obeng & Ahiakpor, (2014), most farmers in sub-Saharan Africa have no formal education. This is evident in this study as 46% of farmers have had no basic education. Farmers' participation in Business Schools organized for them by Cocoa Extension Agents and other stakeholders contributes greatly to their knowledge of farming as confirmed by [10]. Teachings at the Business school expose farmers to how they can create business out of their activities, hence generating

alternative income. Most of the respondents were not regular participants of FBS as shown in Table 1 hence, a major influence on their decision to adopt certain agricultural strategies.

Years of farming experience have a greater influence on one's decision to adopt a particular technology or not (Alare, 2015). From Table 1, the majority (36.8%) have farming experience above 21 years. Thus, they know the dos and don'ts of farming, the appropriate methods to use, and are familiar with weather condition prediction. The majority of the farmers (44.6%) practice sharecropping thus, either the produce is divided into two (Abunu) between the farmer and the landowner or it's divided into three (Abusa) amongst the farmer and the owner. This type of farm ownership restricts farmers from trying a lot of agricultural technologies introduced because they do not own their farmlands directly [19].

The rate of annual pruning has not been stable however, it has been increasing over the years as shown in Table 2. This is because farmers are educated at their various Cooperatives on how to go about pruning and its benefits by the various extension officers. On-site-specific fertilizer application aids in effective cocoa management and production. From the data gathered in the field, farmers are familiar with the benefits of applying precise fertilizer. However, regardless of the quantity of specific fertilizer applied, farmers still recorded a reduction in production as presented in Figure 2. Annual pollination is an exercise for cocoa trees to protect the cocoa trees from pests and diseases hence, enhancing the effective growth of the cocoa tree. The rate of annual pollination is low from 2017 to 2021as shown in Table 2 because it's an exercise, solely done by extension agents and other contract staff. Without these farmers, most farmers are not able to practice it themselves. This has led to the spread of CSSVD within the district, hence reducing the rate of cocoa production in the district as shown in Figure 2.

A Cronbach's Alpha value closer to 1, depicts a high level of internal consistency between the variables measured. From Table 3, it was revealed that there is a high level of consistency between the responses given by farmers on the benefits of adopting additional livelihoods. Out of 127 farmers who had adopted AL as shown in Figure 3, 80 of them agreed that they have been able to purchase farm inputs to help the growth of their cocoa. The finding of this study is consistent with the findings of [15] who found out that farmers who engaged in off-farm activities could purchase agrochemical inputs since the off-farm activities serve as an alternative source of income. Factors such as land tenure system, land topography, land size, shocks, and threats, were categorized as Environmental factors which are statistically significant as shown in Table 4.

Most of the farmers interviewed practice the sharecropping system which is locally known as Abunu and Abusa. The result of this study is consistent with the findings of [19], and Issahaku & Abdulai (2020) who revealed that most farmers who do not own their farmlands mostly find it difficult to engage in some off-farm activities. In confirmation, some ALs depend on farm produce to thrive. Examples are Gari processing, Palm oil and kernel processing, Livestock rearing, and others. Since most farmers practice sharecropping, they are expected to share their produce with their respective landowners [21]. This does not allow farmers to have enough raw materials to engage in Als that rely on farm produce such as cassava, palm oil, mushrooms, and others. Also, natural occurrences such as drought, flood, pest infestation, and other shocks contributed to farmers' decision not to adopt ALPs.

Access to credit facilities and access to affordable farm inputs were classified as Financial Accessibility as shown in Table 4. Every activity, either on-farm or off-farm requires a portion of capital to begin [22]. The study revealed that farmers' inaccessibility to adopt ALs was a result of financial constraints which is consistent with the findings of Age, level of education, household head status, religious background, gender, and remittances composed the sociocultural factors of the model as shown in Table 4. Studies have revealed that farmers with no level of education find it difficult to easily adopt a particular technology. With SLs, financial record keeping is a foundation since CEAs sometimes 'inspect' the financial records of farmers who engage in other ALs.

The results of the study revealed that aged farmers, farmers with no level of education, and female farmers find it difficult to venture into ALs and this result is consistent with the findings of. Organic farming and ancient cultural beliefs contributed to the personal factor which was not statistically significant as shown in Table 4. A typical traditional belief that one is supposed to concentrate on one job and not more than two, does not affect why a farmer has not ventured some ALs. One's decision to practice organic

farming does not hinder him or her from adopting ALs. Hence, farmers who practice organic farmers could still venture some ALs if they want to [23].

5. CONCLUSION

Non-adoption of ALs by farmers can be attributed to a lot of factors such as nonparticipation in FBS, financial inaccessibility, land tenure system, and many more. However, farmers who have adopted some ALs have increased their income level, increased food security, and a general increase in livelihood. The findings of the study revealed that cocoa production is decreasing as the years go by in the study area hence a wakeup call for farmers to find alternative sources of livelihood.

This would prevent poverty and low standard of living among smallholder cocoa farmers. The study concludes that most farmers have not adopted ALs due to a lot of factors hence, it is therefore recommended that the government and other stakeholders should set up credit facilities for farmers for them to access loans for other businesses. Also, materials to practice and set up some ALs should be freely available for farmers who voluntarily participate in FBS where common knowledge and business ideas are shared. All other factors hindering farmers' decision to adopt ALs should be duly considered.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Dorcas Twumwaa Gyan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Esi Dadzie	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sheena Dorcoo	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Edmound Oti Boateng	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Jeff Dacosta Osei	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

C: **C**onceptualization
M: **M**ethodology
So: **So**ftware
Va: **Va**lidation
Fo: **Fo**rmal analysis
I: **I**nvestigation
R: **R**esources
D: **D**ata Curation
O: Writing - **O**riginal Draft
E: Writing-Review & **E**diting
Vi: **Vi**sualization
Su: **Su**pervision
P: **P**roject administration
Fu: **Fu**nding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study, and their voluntary consent was obtained prior to data collection.

Ethical Approval

Not applicable.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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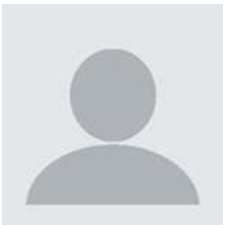
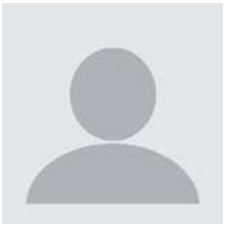
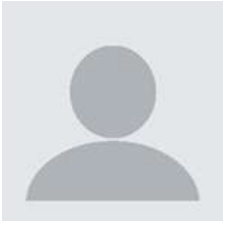
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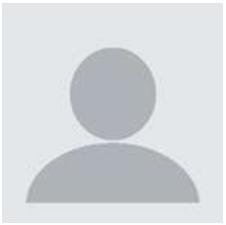
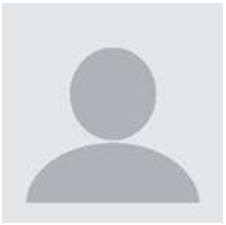
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