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Beyond certification: Investigating the nexus between compliance with sustainable agriculture standard and livelihood assets of certified smallholder cocoa farmers in Ghana

Fred Ankuyi[1]*, Enoch Kwame Tham-Agyekum[1], Daniel Ankrah[2], Akua Yeboah Oduro-Owusu[1], John-Eudes Andivi Bakang[1], David Boansi[1] and Solomon Asirifi[1]

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*Corresponding author: Fred Ankuyi, Department of Agricultural Economics, Agribusiness and Extension, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana
E-mail: fredankuyi@gmail.com

Reviewing editor:
María Luisa Escudero Gilete, Nutrition and Bromatology, Universidad de Sevilla, Spain

Additional information is available at the end of the article

Abstract: Studies have shown that farmers appear to deviate from set certification standards after they have passed audits and received their certificate. This usually makes them vulnerable and affects their livelihood assets. Therefore, this study set out to investigate the nexus between certified smallholder cocoa farmers' continual compliance with sustainable agriculture standard (SAS) and their livelihood assets. The research was conducted in the Sefwi Wiawso Municipality of Ghana. Data were collected from a survey of 400 cocoa farmers. Ordered logistic regression modelling, Chi-square test, frequencies, means, standard deviations, and percentages were used to analyze data. The findings show that 43.5% of the certified cocoa farmers

ABOUT THE AUTHORS

Fred Ankuyi holds an MPhil. degree in Agricultural Extension and Development Communication from KNUST, Ghana.
Enoch Kwame Tham-Agyekum is a lecturer at KNUST, Ghana. His key areas of interest are Development Communication and Media Studies, Monitoring and Evaluation, Gender, Extension Education and Rural Development.
Daniel Adu Ankrah is a Senior Lecturer at the University of Ghana. His research interest includes Agri-food Systems, Agricultural Education and Extension, Gender, Climate Change and Food Security.
Akua Yeboah Oduro-Owusu is an MPhil student in Agricultural Extension and Development Communication from KNUST, Ghana.
John-Eudes Andivi Bakang is an Associate Professor at KNUST, Ghana. He has over 25 years of teaching experience in Agricultural Extension.
David Boansi is a lecturer at KNUST, Ghana. His key areas of interest are Agricultural Economics, International Economics, Agricultural Policy, International Trade and Climate Change.
Solomon Asirifi is an MPhil student in Agricultural Extension and Development Communication at KNUST, Ghana.

PUBLIC INTEREST STATEMENT

This study explores how cocoa farmers' adherence to sustainability standards changes after certification and its impact on their well-being. Conducted in Ghana's Sefwi Wiawso Municipality, researchers surveyed 400 certified cocoa farmers. Results showed that 43.5% moderately complied with sustainability standards. Factors like gender, farm size, land ownership, access to credit, non-farm income activities, and external support influenced compliance levels. Interestingly, complying with sustainability standards positively affected farmers' overall livelihood assets. The study suggests that increasing credit access for cocoa farmers should go hand-in-hand with promoting sustainable farming education. This approach aims to ensure both economic stability and environmentally-friendly practices. The findings highlight the need to support farmers in maintaining sustainability even after certification.

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complied moderately with SAS. Gender, farm size, land ownership, access to credit, engaging in income-generating activities outside of farming, assistance provided by License Buying Companies and extension contact were the determinants of farmers' level of compliance with SAS. The study revealed a statistically significant association between farmer compliance and livelihood assets. Efforts to increase access to credit for cocoa farmers must be accompanied by efforts to promote and educate farmers on sustainable farming practices.

Subjects: Agriculture & Environmental Sciences; Environmental Issues; Rural Development

Keywords: certified cocoa farmers; compliance; non-compliance; rainforest alliance; standards

1. Introduction

The term "certification" pertains to the extensive range of voluntary standards created by third-party organizations, against which farmers are audited and verified independently, or in some cases, certified. Certification largely increases the producers' environmental, social, and economic security (Arnould et al., 2009). Lipschutz (2015), understands certification as a "social contract" linking consumers and producers. Millard (2011) contends that certification should be principally seen as a market-based instrument to encourage farmers to use sustainable farming techniques.

Cocoa certification is a system that is used to verify that all parties in the cocoa supply chain adhere to the relevant environmental, social and economic criteria (Jena et al., 2012; Rueda & Lambin, 2013). The primary objective of cocoa certification is to ensure the long-term viability of the cocoa value chain. It raises the quality of the beans and aids farmers in using good agricultural practices. Studies have shown that cocoa certification in Ghana has had varied effects on the environment and the economy (Fenger et al., 2017; Waarts et al., 2015), with core causes being the ineffective application of certification standards because of the high costs of investment (Fenger et al., 2017), certification impacts that are not immediately apparent (Waarts et al., 2015), and the quick renunciation of good production methods after its acceptance (Ansah et al., 2020).

Compliance is a type of reaction to an implicit or explicit request to follow a set of standards (Boyd & McNevin, 2015). It has been well-documented that farmers' level of practice of certification is low (Famuyiwa et al., 2018; Herman et al., 2020). The reason is that they prioritize the certificates over improving their practices over time as they have not fully adopted the programme (Waarts et al., 2015). Hence, few farmers are embracing the requirements (Deppeler et al., 2014). Farmers deviate from the set standards after they have passed the audit and received a certificate. This is in sharp contrast to the Sustainable Agriculture Standard's core principle of continuous improvement, which encourages farmers to improve their practices over time. After passing the audit and receiving the certificate, farmers are expected not to abandon sustainable practices (Alliance, 2020).

The repercussions of sustainability standards as championed by Rainforest Alliance (RA)[1] are largely determined by farmers' willingness to comply with its principles and indicators. Farmers must modify existing farming techniques and farm operations, among other things, to satisfy the expectations set forth in these indicators and principles (Tlusty & Tausig, 2015).As explained by the theory of expectancy-value, a direct connection is expected between a person's performance (livelihood assets), perseverance (continual compliance), and choice of practice (sustainable agriculture standard) (Wigfield & Cambria, 2010). Cocoa farmers are therefore expected to make behavioural decisions by choosing SAS and continue practising them even after certification so that their livelihood assets will be improved.

Numerous studies have looked at the issue of farmer compliance with certification programmes. Mushobozi (2010) and Pongvinyoo (2015) studied the factors that influence farmers' compliance with certification. These authors argue that farmers' compliance is influenced by a variety of regulatory, economic and human incentives, lower production costs, higher profits, higher capitalization of farm assets, improved farmer skills, community development and lower risks. In addition, factors such as education, membership in farmer organizations, age (Annor et al., 2016; Ogola et al., 2015), infrastructure (Pandit et al., 2017; Parikhani et al., 2015), institutional factors (Tyler, 2006), economic variables (Annor, 2018), quality assurance systems, safe environment (Ogola et al., 2015), knowledge and attitudes levels of producers (Ramcilovic-Suominen & Hansen, 2012; Som et al., 2017) are factors that affect farmer's decision to follow certification protocols.

Other studies focus on certification and performance analysis (Bandanaa et al., 2021; Herman et al., 2020; Lescuyer and Bassanage, 2021), willingness to adopt (Aidoo & Fromm, 2015; Boufous et al., 2023; Yiridomoh et al., 2022), farmer involvement (Ansah et al., 2020; Iddrisu et al., 2020; Paschall & Seville, 2012; Rusli & Fatah, 2022), the impact of certification (Dragusanu et al., 2014; Ingram et al., 2014; Nelson et al., 2013) and farmers' attitudes, knowledge, and exercise of cocoa certification (Famuyiwa et al., 2018). So far, there is little to no information on farmers' level of compliance with cocoa certification after passing audits and receiving their certificates. The study, in essence, aims to fill this knowledge gap. The main objective of the study is to investigate the nexus between certified smallholder cocoa farmers' continual compliance with sustainable agriculture standard (SAS) and their livelihood assets. Specifically, the paper seeks to; assess farmers' level of compliance with SAS, determine the factors that influence farmers' compliance with SAS and the association between the level of compliance with SAS and farmers' livelihood assets. The research was conducted in Ghana due to its position as the world's second-largest cocoa producer and its substantial population of over 800,000 small-scale farmers (ICCO, 2020).

1.1 Certification and livelihood assets

Farmers who are certified are typically more food secure than conventional farmers since studies have found a correlation between certification and food security (Masson, 2011). Adopting certification can reduce the poor living conditions, low yields, and unfavourable social and environmental effects of Ghana's current cocoa-producing methods (Brako et al., 2021; Fenger et al., 2017; Waarts et al., 2015). This notwithstanding, Jena et al. (2012) and Chiputwa et al. (2015) argue that the impact of certification on poverty was insignificant. According to Chiputwa et al. (2015), there may be differences in the livelihood effects of cocoa certification based on several variables, including the type of standard and regional context. As a result, generalizations about how sustainability norms affect smallholder farmers are unjustified. According to Chiputwa et al. (2015), certified farmers enjoy much better living conditions than non-certified farmers.

Previous studies (Arnould et al., 2009; Chiputwa et al., 2015; Jena et al., 2012; Utting, 2009; Vellema et al., 2015) have highlighted the correlation of certification with human capital i.e., education attainment, increased in schooling, improvement in skills level and agronomic practices, improved health by employing more responsible methods of storing and using agrochemicals, improved waste management and use of personal protective equipment. The impact of certification on education in Central America, however, was shown to be modest by Mendez et al. (2010). There is evidence to suggest that certification is associated with natural capital i.e., a positive attitude towards environmental protection, greater inclination to invest in tangible assets, like processing machinery, enhanced management of soil and water resources, and improved watershed protection and physical assets i.e., investment in better infrastructure (including on-farm investments and upgraded housing) measures (Chiputwa et al., 2015).

On the other hand, Utting (2009) points out that payment of premiums at the cooperative level is typically insufficient to motivate investing in real physical assets within specific communities, especially over the near term. Certification has increased financial capital i.e., higher incomes, improved yields, lower input cost, and improved access to credit (Jena et al., 2012; Ruben & Fort,

2012; Utting, 2009) and social capital i.e., access to social networks and increased in reliance of labour (Ruben et al., 2009; Kasente, 2012). However, Bray and Neilson (2017) stated that the benefits of certification rarely result from certification solely but rather from a combination of other local characteristics, including local infrastructure, market structures, administrative capabilities, and levels of education and ability.

2. Materials and methods

The study was carried out in the Sefwi Wiawso Municipality of the Western North Region of Ghana. The Municipality is located in the tropical rainforest climatic zone, with year-round temperatures ranging from 25°C − 30°C and annual rainfall ranging from 1524 mm − 1780 mm. This area's rainfall pattern is distinctive, making it ideal for agricultural activity. It features two prolonged wet periods followed by a brief dry period. Owing to the composition of the soil (thus, Oxisols and Ochrosols) coupled with intense downpours of up to 178 mm per day, severe flooding is experienced in several communities. Muro in Boako (167.8 km^2), Suhuma in Old Adiembra/Amafie (359.8 km^2) and Tano Suhien in Punikrom (84.6 km^2) are the three (3) forest reserves governed by the Municipality (www.ghanadistricts.com).

This study was conducted with all Rainforest Alliance-certified smallholder cocoa farmers in the Sefwi Wiawso Municipality. The study focused on only Rainforest Alliance-certified smallholder cocoa farmers because Rainforest Alliance is the largest cocoa certifier globally (Fountain & Hütz-Adams, 2020). With a total population of 8,658 farmers, the Yamane formula was used to determine the sample size. The formula is given as:

$$\mathrm{n} = \frac{N}{1 + N(\mathrm{e})^2} \tag{1}$$

Where: n = sample size required, N = sampling frame (8,658), e = margin of error (5%), Substituting 8,658 and 0.05 into the formula, we have; $\mathrm{n} = \frac{8658}{1+8658(0.05)^2}$, $n = 382$.

Although the computed sample size was 382, it was adjusted to 400 to cater for non-responsive respondents. A multi-stage sampling process was used to choose a sample of the respondents. The Western North Region and Sefwi Wiawso Municipality were purposely selected due to their significant cocoa production levels within Ghana. Furthermore, the municipality has been engaged in cocoa certification for more than eight years. Lastly, the municipality had previously implemented the Rainforest Alliance Sustainable Agriculture Network standard and the UTZ code of conduct before their amalgamation. This makes their farmers well vest and appropriate to be used for the study. Cluster sampling was then employed to group the towns into four spatial clusters (Nsawora, Penakrom, Asawinso and Tanoso). From each of the clusters, the communities and RA-certified farmers were drawn using the simple random sampling technique in proportion to their size from the list provided by field assistants of the RA programme. The communities and the number of respondents sampled were: Odumasi-28, Kwasiaddaekrom (46), Asiekrom (29), Medina (41), Ayisakrom (45), Ahokwa (54), Gyatokrom (40), Baakonka (18), Kessekrom (46), Kwamebour (31) and Anwhiam (22). A questionnaire was used as the data collection instrument and it was administered to the respondents through a face-to-face interview from 26th March to 24 May 2022. Frequencies, means, standard deviations, ordered logit model and chi-square test of independence were used to analyze the data, aided by the Stata statistical software.

To determine the level of farmer compliance with SAS, the number of farmers complying with each practice was first determined, followed by employing a grading system adapted and modified from Sarea et al. (2017) and Anaglo et al. (2014) to group the farmers. Farmers were then grouped into levels based on the grading system. The requirements of the Rainforest Alliance cited in the SAS for certified cocoa production (Version 1, 2020) was considered to measure the compliance of RA-certified cocoa farmers. Practices from the SAS that were considered in this study were; pruning of farms, use of recommended fungicides, use of recommended pesticides, trained persons applying agrochemicals, storage of agrochemicals in locked

storage, harvesting at the right time, regular monitoring of pests, weed management strategies (manual), the volume of insecticide applied, time of insecticide application, appropriate weeding frequency, provision of pesticides bath on farms, equal remuneration without discrimination for work of equal value and fertilizer application. Respondents who complied with 0–5 practices (≤40%) were classified as low-level compliance. Those that complied with 6–9 (≥40% − 70%) practices were classified as medium-level compliance while those who complied with 10–14 practices (≥70%) were classified as high-level compliance.

The ordered logistic regression model was used to analyze the socio-economic factors that influence farmers' level of compliance with the SAS (Greene, 2008; Ingelmo et al., 2011). Compliance (dependent variable) was categorized into three groups: 0 = low compliance, 1 = medium compliance, and 2 = high compliance. Let y denote the observed compliance level of farmer i, y^* the latent compliance measure. x is the matrix of independent variables. $j = 3$ in the study. The latent regression of compliance of y_i^* is as follows:

$$y_i^* = x_i\beta + \varepsilon i. \tag{2}$$

where i is the observation, β is the regression coefficient for x, ε is the error term. Let μ_k be compliance thresholds = 1, 2, … j. $_k = 1$ represents the minimum threshold (low compliance). The y values are represented as

$$\begin{aligned} &y = 0 \text{ low compliance if } y^* \le \mu_1 \\ &y = 1 \text{ medium compliance if } \mu_1 < y^* \le \mu_2 \\ &y = 2 \text{ high compliance if } y^* > \mu_3 \end{aligned} \tag{3}$$

Where a j represents the number of compliance levels (categories). The universal form of the possibility that the observed y falls into categories j, μ and β are to be assessed with the ordered logit model is

$$prob(y = j) = 1 - L\left(\mu_{j-1} - \sum_i^k \beta_k x_k\right) \tag{4}$$

Where L signifies collective logit distribution. The β values for all j compliance levels are the same. However, the parallel line of assumption may often not hold (Sasidharana & Menéndez, 2014). Table 1 below describes the independent variables that were used for the ordered logit regression model.

To measure the association between certified smallholder cocoa farmers' compliance with SAS and livelihood assets, the independence chi-square test was utilized. In measuring the change in livelihood assets, farmers were made to indicate whether their livelihood assets have either increased, remained unchanged or decreased for the past five (5) years since they enrolled on the rainforest alliance cocoa certification programme (Table 2).

3. Results and discussion

3.1 Socio-demographic characteristics of certified smallholder cocoa farmers

Table 3 below provides a detailed report of the socioeconomic (continuous variables) characteristics of the certified smallholder cocoa farmers.

The mean age of the certified cocoa farmers was 48.6 years. This shows that certified farmers in the municipality were above the youthful age (15–35 years) which agrees with Wongnaa et al. (2021) and Ankuyi et al. (2022). The average number of years spent by a certified farmer in school is 5 years confirming the low level of education of cocoa farmers in Ghana (Asamoah & Owusu-Ansah, 2017). According to Wongnaa et al. (2021), years spent in school could have an effect on compliance.

Table 1. Independent variables used for the ordered logit regression model

Variable	Measurement	Expected outcome	Source
Age of Respondents	Continuous: years	+/-	Annor et al. (2016), Ogola et al. (2015), Parikhani et al. (2015), Pandit et al. (2017), Tyler (2006), Annor (2018), Ramcilovic-Suominen and Hansen (2012) and Som et al. (2017)
Years of Schooling	Continuous: years of formal schooling	+/-	
Household Size	Continuous: number of persons living with the respondent	+/-	
Farm Size	Continuous: the size of the cocoa farm in acres	+/-	
Farming Experience	Continuous: years of working as a cocoa farmer	+/-	
Training Attendance	Continuous: number of training programmes attended in a year	+/-	
Number of farms	Continuous: number of farms owned by respondent	+/-	
Marital status	Dummy: 1 = Married, 0 = Single	+	
Gender	Dummy: 1 = Male, 0 = Female	+	
Land Ownership	Dummy: 1 = Yes, 0 = No	+	
Credit Access	Dummy: 1 = Yes, 0 = No	+	
Extension Contact	Dummy: 1 = Yes, 0 = No	+	
LBC Support	Dummy: 1 = Yes, 0 = No	+	
Participation in off-farm income activity	Dummy: 1 = Yes, 0 = No	±	

On average, the household size of certified cocoa farmers was 7. The finding is supported by Denkyira et al. (2017) who reported the average household size of farmers to be 7. They argued that an average household size of 7 is an indication of a large family size. As asserted by Owombo et al. (2014), a larger household size could lower a household's cost of hiring labour. This is because members of the household could be used as farm hands to assist in farms' activities. The average farm size was 4.7 acres which agrees with Opoku-Ameyaw et al. (2010) that the majority of cocoa farmers in Ghana have small farms. The average farming experience among the certified cocoa farmers was 22.5 years, with a minimum of 1 year and a maximum of 45 years. This implies that there is a wide range of experience levels among certified cocoa farmers. Having an average farming experience of 22.5 years could suggest that the cocoa farmers are experienced and have been working in the industry for a long time. This could indicate that they have developed knowledge and skills in cocoa farming, which may lead to increased productivity and better-quality cocoa beans. Asamoah and Owusu-Ansah (2017) found as high as 70 years of maximum experience of cocoa farmers in their study.

On average, certified cocoa farmers attended training three times a year. This ranged from no training attendance i.e., 0 to a maximum of five (5). The results show that certified cocoa farmers had between one and five cocoa farms to manage under various land tenure arrangements. Asamoah and Owusu-Ansah (2017) asserted that cocoa farmers usually operate under various tenurial statuses and arrangements. For instance, a farmer may own and operate his or her cocoa farm while working as a sharecropper on another farmer's land or may have a tenuous relationship with someone else who is looking after the farmer's property on his or her behalf.

Table 2. Measurement of change in livelihood assets of certified smallholder cocoa farmers

Social Assets	**Measurement**	**Source**
Participation in farmer association	Categorical: 3=increased, 2=unchanged, 1=decreased	Ruben et al. (2009) and Kasente (2012)
Support from farmer groups		
Support to other family members		
Support to friends		
Payment of funeral dues		
Payment of development dues		
Participation in naming ceremonies		
Participation in funerals		
Participation in communal labour		
Trust in community leaders		
Natural Assets	**Measurement**	
Yield per acre	Categorical: 3=increased, 2=unchanged, 1=decreased	Chiputwa et al. (2015)
Quality of beans		
Cocoa farm size		
Number of farms		
Number of Farm animals		
Financial Assets	**Measurement**	
Cocoa farm income	Categorical: 3=increased, 2=unchanged, 1=decreased	Ruben and Fort (2012), Jena et al. (2012) and Utting (2009)
Payment for labour		
Non-farm income		
Debt levels		
Access to credit		
Savings levels		
Physical Assets	**Measurement**	
Ownership of knapsack machine	Categorical: 3=increased, 2=unchanged, 1=decreased	Chiputwa et al. (2015)
Ownership of mist blower		
Ownership of pruner		
Ownership of machete		
Ownership of baskets		
Ownership of raffia mats		
Ownership of household appliance		
Ownership of harvesters		
Ownership of a house		
Human Assets	**Measurement**	
Access to skilled labour	Categorical: 3=increased, 2=unchanged, 1=decreased	Arnould et al. (2009) and Jena et al. (2012)
Payment of wards' school fees		
Access to private extension		
Ability to register households on NHIS		
Access to COCOBOD extension services		
Access to unskilled labour		

Table 3. Socio-demographic characteristics (continuous variables) of smallholder cocoa farmers

Variables	Mean	Std. Dev.	Min.	Max.
Age of Respondents	48.6	11.9	21	78
Years of Schooling	4.9	5.0	0	16
Household Size	6.7	3.1	1	20
Farm Size	4.7	3.4	1	20
Farming Experience	22.5	10.1	1	45
Training Attendance	3.0	1.4	0	5
Number of farms	2.5	1.2	1	5

Source: Field Survey, 2022.

Table 4 provides a detailed description of the socioeconomic (discrete variables) characteristics of the certified smallholder cocoa farmers. The discrete variables include gender, marital status, land ownership, credit access, extension contact, LBC support and participation in off-farm income activity.

In terms of gender, the male representation was 56.3% while the females made up of 43.8%. This indicates that there are more men than women. The gender imbalance may reflect broader societal norms and expectations around gender roles in agriculture and farming. For example, in some cultures, it may be more common for men to work in agriculture while women are expected to take on domestic roles. This could lead to fewer women pursuing careers in agriculture and fewer opportunities for women to participate in farming activities. The fact that male respondents outnumbered female respondents among farmers may be due to men's easier access to farmland than women. It might also be because producing cocoa requires more labour than other crops. As a result, women are unable to invest the necessary time and effort in growing cocoa. The finding is supported by Gideon (2010) and Yahaya et al. (2015) who reported that certified cocoa farmers are mainly males. The marital status of certified cocoa farmers shows that 80.8% were married, while 19.8% were unmarried. The findings show that married individuals make up the bulk of cocoa farmers. Marital status can be an important factor in farming practices and outcomes, as it may

Table 4. Socio-demographic characteristics (discrete variables) of smallholder cocoa farmers

Variables	Category	Frequency	Percentage (%)
Gender	Male	225	56.2
	Female	175	43.8
Marital Status	Married	321	80.2
	Unmarried	79	19.8
Land Ownership	Own land	344	86.0
	Others	56	14.0
Credit Access	Yes	330	82.5
	No	70	17.5
Extension Contact	Yes	378	94.5
	No	22	5.5
LBC Support	Yes	150	37.5
	No	250	62.5
Participation in off-farm income activity	Yes	225	56.2
	No	175	43.8

Source: Field Survey, 2022.

impact access to labour and financial resources. Married farmers may have access to more labour resources, as they can rely on their spouses and children for help in farming activities. In addition, they may have greater access to financial resources through shared household income and assets. Previous studies by Asamoah and Owusu-Ansah (2017), Gideon (2010) and Yahaya et al. (2015) estimated between 77% to 90% of cocoa farmers are married.

In terms of land ownership, 86% of the certified cocoa farmers owned lands while 14% were under other land tenure arrangements such as *abunu* and *abusa* sharecropping arrangements. The result indicates that the majority of the certified cocoa farmers owned their land, while a smaller percentage were under other land tenure arrangements, such as *abunu* and *abusa* sharecropping arrangements. Asamoah and Owusu-Ansah (2017) and Baah et al. (2011) also found cocoa farm owners to be 71.4% and 80% respectively. About 82.5% of the certified cocoa farmers reported that they had access to credit while 17.5% indicated otherwise. The majority (94.5%) of the respondents were contacted by extension agents. The fact that a high percentage of respondents were contacted by extension agents suggests that there is a strong extension system in place to support cocoa farmers. This is a positive sign, as access to extension services can be a crucial element in raising agricultural output and sustainability. About 56.3% of the certified cocoa farmers were participating in various off-farm income-generating activities while 43.7% were not. About 62.5% of the certified cocoa farmers reported that they did not receive support from other LBCs while 37.5% indicated otherwise. Support from LBCs includes access to fertilizers and chemicals. The fact that 62.5% of the certified cocoa farmers did not receive support from other LBCs suggests that there may be gaps in the support and resources available to farmers in the cocoa sector.

3.2 Compliance with SAS

Table 5 shows the list of practices considered in the study and the number of certified smallholder cocoa farmers complying with each of the standard practices. The five (5) key sustainable practices complied by the certified smallholder cocoa farmers were weed management strategies (manual) (76.5%), use of recommended fungicides (74.3%), use of recommended pesticides (69.8%), pruning of farm (68.8%) and appropriate weeding frequency (66.5%) while the two least complied sustainable practices were fertilizer application (17.8%) and provision of pesticide baths on farms (14%).

About 76.5% (306) of the certified cocoa farmers interviewed complied with weed management strategies. This shows that the majority of the certified farmers prefer to manually weed their farms than use weedicides. The fact that a high percentage of certified cocoa farmers complied with weed management strategies is a positive sign for the cocoa sector. It suggests that farmers are taking steps to manage weeds effectively, which could contribute to increased yields and improved cocoa bean quality. Weeds are a barrier to the production of cocoa, and weed control in farming is known to minimize weed management costs, enable greater plant growth and ensure a weed-free environment over a longer period (Konlan et al., 2019; Olufemi et al., 2020). About 68.8% (275) of the certified cocoa farmers complied with the pruning of their farms. The fact that 68.75% of certified cocoa farmers complied with pruning practices is a positive sign for the cocoa sector. It implies that farmers are conscious of the significance of this practice and are taking steps to implement it on their farms. Olutegbe and Sanni (2021) reported slightly higher farmer compliance with pruning (79.3%). Pruning is a crucial low-cost option that experts in the field of tree crops highlight as a means of boosting output (Tosto et al., 2022).

About 74.3% of the certified cocoa farmers complied with the use of recommended fungicides, while 69.8% of the farmers complied with the use of recommended pesticides. The fact that a high percentage of certified cocoa farmers complied with the use of recommended fungicides and pesticides is a positive sign for the cocoa sector. It suggests that farmers are aware of the importance of using these products responsibly and are taking steps to ensure their proper use. A study by Sowunmi et al. (2019) agrees that by using the proper amount of fungicides on cocoa

Table 5. Certified smallholder cocoa farmers' compliance with sustainable agriculture standard

Practices	Yes	Percentage (%)	No	Percentage (%)
Weed management strategies (manual)	306	76.5	94	23.5
Use of recommended fungicides	297	74.3	103	25.7
Use of recommended pesticides	279	69.8	121	30.2
Pruning of farm	275	68.8	125	31.2
Appropriate weeding frequency	266	66.5	134	33.5
Harvesting at the right time	264	66.0	136	34.0
Equal remuneration without discrimination for work of equal value	248	62.0	152	38.0
Regular monitoring of pests	230	57.5	170	42.5
Application of insecticides at the right time	214	53.5	186	46.5
Applying the correct volume of insecticide	211	52.8	189	47.2
Storage of agrochemicals in locked storage	162	40.5	238	59.5
Only trained persons applying agrochemicals	120	30.0	280	70.0
Fertiliser application	71	17.8	329	82.2
Provision of pesticide baths on farms	56	14.0	344	86.0

Source: Field Survey, 2022.

farms, the productivity of cocoa can be increased while reducing the environmental consequences of copper fungicides. However, Antwi-Agyakwa et al. (2015) argued that many cocoa farmers do not adhere to recommended safety measures. As a result, they are exposed to significant occupational health risks, with some documented cases of death and severe disability brought on by the improper application of agrochemicals.

The result indicates that almost 66.5% of certified cocoa farmers were weeding at the appropriate frequency, which is at least three times a year or every four months. This is a positive sign for the cocoa sector as it suggests that the majority of farmers are aware of the importance of weeding and are taking steps to control weeds on their farms. Weeding is a crucial practice in cocoa farming as it helps to control weed growth and prevent competition for nutrients, water, and sunlight between weeds and cocoa trees. Weeding also helps to control pests and diseases that can thrive in weed-infested areas. The finding contradicts that of Olutegbe and Sanni (2021) who reported that only 30% of farmers interviewed in Ondo state, Nigeria complied with weeding at the appropriate frequency. The result shows that only 17.8% of the certified cocoa farmers complied with fertilizer application. This is a concern for the cocoa sector as fertilizers are an important tool for improving soil fertility and crop yields. Fertilizer applications can help to ensure that cocoa trees

have access to the necessary nutrients for healthy growth and productivity. Farmers are not complying with fertilizer applications because they do not have access to affordable and high-quality fertilizers. They linked this to the scarcity and expensive price of fertilizers. This is in agreement with the findings by Olutegbe and Sanni (2021) who found that only 6% of cocoa farmers were compliant with fertilizer application. In terms of the use of pesticide baths on farms, only 14% of the certified cocoa farmers complied.

The results indicate that certified cocoa farmers complied with 10 out of 14 recommended sustainable standards at a rate of 50% or above. This is a positive finding as it suggests that the majority of certified cocoa farmers are aware of and implement sustainable practices on their farms. The fact that certified cocoa farmers are complying with 10 out of 14 recommended sustainable standards is a promising sign for the cocoa sector. However, there is still room for improvement, as compliance rates for some standards are lower than desirable. For example, the low compliance rate for fertilizer application, as discussed in a previous response, indicates that more work needs to be done to promote the use of fertilizers responsibly and sustainably. Olutegbe and Sanni (2021) reported that 54% of farmers complied with good agronomic practices in cocoa, while 46% did not comply with the guidelines. In explaining the reason for the incomplete compliance of farmers with recommended practices, Wongnaa et al. (2021) asserted that compliance is seen as a personal choice made by each smallholder farmer. The probability that a farmer will choose to follow a specific recommendation is determined by the likelihood that the satisfaction they would experience from that alternative is greater than the satisfaction they would experience from any other alternative; as a result, whether they choose to follow the recommendation or not, they will favour the alternative that maximizes their satisfaction.

3.3 Level of compliance

Table 6 presents the number of certified smallholder cocoa farmers belonging to each of the three levels of compliance.

Table 6 presents compliance levels of certified cocoa farmers with recommended sustainable standards. The statement indicates that about 27.2% of the farmers had a low level of compliance, 43.3% had a moderate level of compliance, and 29.5% had a high level of compliance. The breakdown of compliance levels in Table 6 provides important insights into the state of sustainable cocoa farming practices among certified cocoa farmers. The fact that a significant proportion of farmers had a high level of compliance is encouraging, but the fact that some farmers had a low level of compliance highlights the need for continued efforts to promote sustainable practices and support farmers in implementing them effectively. In agreement, Kassem et al. (2021) also found that farmers are moderately complying with Global good agricultural practices. However, the findings disagree with the conclusions of Wongnaa et al. (2021) who reported that farmers complied less with recommended production measures.

3.4 Factors affecting certified cocoa farmers' compliance with SAS

Ogola et al. (2015) postulated that the choice of a farmer to follow a practice can be explained in terms of the traits of the farmer, the traits of the farm, and the traits of the crop. In Table 7, the estimates of the ordered logit regression parameters for the socio-economic variables that affect

Table 6. Certified smallholder cocoa farmers' compliance level

Level of compliance	Frequency	Percent
Low	109	27.2
Moderate	173	43.3
High	118	29.5
Total	400	100

Source: Field Survey, 2022.

Table 7. Factors influencing certified smallholder cocoa farmers' level of compliance with sustainable agriculture standard

Explanatory Variables	Coef.	Odds Ratio	Std. Err.	P-value
Gender	0.36*	1.44	0.29	0.07
Age	0.01	1.01	0.01	0.53
Married	0.10	1.11	0.26	0.67
Size of Household	0.02	1.02	0.03	0.49
Farm Size	−0.05*	0.95	0.03	0.09
Farming Experience	0.00	1.00	0.01	0.69
Years in School	−0.00	1.00	0.02	0.89
Training Attendance	−0.07	0.93	0.07	0.39
Land Ownership	0.66***	1.92	0.53	0.01
Credit Access	−0.62**	0.54	0.15	0.02
Participation in off-farm income-generating activities	−0.40**	0.67	0.14	0.05
LBC Support	−0.81***	0.44	0.09	0.00
Extension Contact	1.19***	3.30	1.66	0.01
/Cut1	−0.09	−0.09	0.76	
/Cut 2	1.93	1.93	0.77	
LR $chi^2(13)$	41.97			
Prob > chi^2	0.00			
Pseudo r-squared	0.05			
Number of observations	400			

Source: Author's Construct, 2022.

Notes: *** p<0.01, ** p<0.05, * p<0.10.

certified cocoa farmers' level of compliance with SAS are presented. Seven (7) out of the thirteen (13) variables included in the model were significant; gender (10%), farm size (10%), credit access (5%), participation in off-farm income-generating activities (5%), land ownership (1%), LBC support (1%) and extension contact (1%).

Gender was predicted to positively affect farmers' compliance levels. At a 10% level of significance, it was discovered that gender positively and significantly influenced compliance. According to the odds ratio of 1.44, the chances ratio in favour of the level of compliance increases by a factor of 1.44 for male farmers. This demonstrates that certified male cocoa farmers are more likely to fall into a higher compliance level compared to their female counterparts. Since farmer training is scheduled on days and times that are advantageous to them, male farmers may attend them frequently, which has a favourable impact on compliance. As a result of being exposed to the dos and don'ts of SAS, they have a better chance of increasing compliance as compared to the females. Therefore, training events should be scheduled to fit the time availability of women farmers as they often have restricted time availability to attend training. Training events should also be organized at locations that are accessible to women farmers as they have less time to travel and they may face social restrictions regarding travelling outside the community. The result disagrees with Mulwa et al. (2017), and Wongnaa et al. (2021) who argued that female farmers are more likely to comply with recommended technologies than males.

Farm size was predicted to positively influence compliance levels. The result shows that farm size had a negative and significant effect on compliance level at 10%. The odds in favour of

compliance decrease by 0.95 as farm size increases. Thus, certified cocoa farmers with small farm sizes are more likely to comply with SAS than those with large farm sizes. The negative effect could be due to the amount of work required to comply with sustainable standards. Again, compliance requires investing resources such as labour and inputs among others into the farm. A large farm size correlates to investing more resources. Hence, the likelihood of certified cocoa farmers with bigger farm sizes not being able to fully implement sustainable standards. Mwangi and Kariuki (2015) made the point that having a small farm may encourage the adoption of technology, particularly if it involves an innovation that requires a lot of inputs, such as a labour-intensive or land-saving technique. The results contradict the claims made by Wongnaa et al. (2021), who claimed that an increase in farm size would probably result in higher compliance.

Land ownership was anticipated to positively influence compliance levels. The result shows that at a 1% probability level, land ownership had a positive significant effect on farmers' level of compliance. While other variables are held constant, the chances ratio for the level of compliance increases by a factor of 1.92 for certified cocoa farmers who own farmlands compared to their counterparts who do not own farmlands. Thus, farmers who own farmlands are two times more likely to comply than those who do not own lands. The findings suggest that land ownership promotes farmer compliance. SAS comes with initiatives such as planting shade trees on farms which takes a long time before reaping the benefits. Certified cocoa farmers who do not own farmlands could only be interested in practices that will give them benefits in a short time. Because their lands can be taken away from them at any time by the owners. Renters use the land for a shorter duration than owners do, therefore they are less likely to adopt behaviour that will help the environment or themselves in the long run (Liu et al., 2018). The finding is corroborated by Oyetunde Usman et al. (2021), who made the case that land ownership has a key role in influencing the adoption of technology.

It was predicted that access to credit would positively influence farmers' level of compliance. At a 5% level of significance, it was discovered that access to credit had a negative and significant effect on the level of certified cocoa farmers' compliance. Holding other variables constant, the chances ratio for the level of compliance reduces by a factor of 0.54 for certified farmers who have access to credit compared to their counterparts who do not have access to credit. This suggests that cocoa farmers who do not have access to credit will likely comply with sustainable standards more than those who have access to credit. One possible explanation for this negative relationship is that farmers who have access to credit may be more focused on increasing their crop yield to pay back their loans, and therefore may be less inclined to focus on sustainable farming practices. Additionally, farmers who have access to credit may have more financial resources to invest in inputs such as pesticides and fertilizers, which may lead to overuse and improper use of these inputs, resulting in lower compliance levels. The findings are in line with Hando et al. (2022), who discovered that when members' usage and accessibility of credit services grow, they no longer comply with recommended practices.

Participation in non-agricultural income-generating activities was anticipated to either have a positive or negative effect on compliance levels. The resulting value of the ordered logistic regression shows that participation in non-agricultural income-generating activities has a negative and significant impact on the degree of compliance at 5%. While other variables are held constant, the chances ratio for the level of compliance reduces by a factor of 0.67 for farmers who participate in non-agricultural income-generating activities compared to their counterparts who did not participate in non-agricultural income-generating activities. This means that farmers who engage in non-agricultural income-generating activities are less likely to comply with SAS. One possible explanation for this negative relationship is that farmers who engage in non-agricultural income-generating activities may have less time and resources to invest in their cocoa farms, leading to lower compliance levels. Additionally, farmers who engage in non-agricultural activities may have different priorities and goals than those who solely rely on cocoa farming as their main source of income, leading to different attitudes towards sustainable farming

practices. Off-farm income-generating activities occupy most of their time limiting their time to focus on certification activities on their cocoa farms. Quartey et al. (2021) also confirmed that off-farm income had a negative significant relationship with the choice of certification scheme by farmers.

Support from LBC was predicted to significantly affect farmers' compliance levels and was projected to have a positive effect. The logit model results show that support from LBC had a significant negative influence on farmers' level of compliance at a 1% significance level. Holding all variables constant, the chances ratio for the level of compliance reduces by a factor of 0.44 for farmers who had support from LBC compared to their counterparts who did not get support. This means that farmers who received support from LBCs were less likely to comply with recommended sustainable standards. One possible explanation for this negative relationship is that LBCs may prioritize profit over sustainability, leading to a focus on cocoa quantity rather than quality. As a result, LBCs may provide support to farmers that incentivize higher yields and productivity, rather than sustainable farming practices. This may lead to farmers prioritizing short-term gains over long-term sustainability. The results corroborate with those of Hando et al. (2022) who also found a negative and significant relationship between cooperative members' compliance with recommended activities and their access to and use of agricultural inputs.

Extension contact was predicted to positively affect farmers' compliance levels. The model outcome of the study indicates that, at a 1% significance level, extension contact had a significant and positive effect on compliance levels. Holding all variables constant, the chances ratio for the level of compliance increases by a factor of 3.30 for certified cocoa farmers who had extension contact compared to their counterparts who did not have access. This means that farmers who had contact with extension agents were more likely to comply with SAS. One possible explanation for the positive relationship between extension contact and compliance levels is that extension agents provide farmers with trustworthy information (Muhongayire et al., 2013; Tetteh Anang et al., 2015), training, and technical assistance that enables them to adopt and comply with SAS. Another possible explanation is that extension agents serve as a source of motivation and encouragement for farmers to comply with SAS. By providing feedback and recognition for farmers who are complying with these standards, extension agents may help to create a culture of sustainability within the farming community. The findings agree with Owombo et al. (2014) who found that extension access has a positive effect on cocoa farmers' compliance with safety precautions in Nigeria.

3.5 Association between level of compliance and livelihood assets

Table 8 shows a chi-square test of independence for certified smallholder cocoa farmers' level of compliance with SAS and various livelihood assets.

In terms of social assets, there was a statistically significant association ($p < 0.01$) between the level of compliance and participation in a farmer group, support from a farmer group or association, support to other family members, payment of funeral dues, and participation in communal labour. A statistically significant association ($p < 0.05$) was observed between the payment of development dues and the level of compliance. Finally, a significant association ($p < 0.1$) was observed between participation in naming ceremonies and level of compliance. The fact that the association is statistically significant at different levels of significance ($p < 0.01$, $p < 0.05$, $p < 0.1$) indicates varying degrees of strength in the relationship between compliance and social assets. This suggests that farmer compliance with SAS is facilitated and supported by their access to social assets. Once more, the socio-environmental contacts between and among the important local stakeholders in cocoa certification are crucial to the long-term viability of the certification programme. This implies that social assets play a crucial role in promoting and sustaining sustainable farming practices among smallholder farmers. Anaglo et al. (2014) observed a strong relationship between group membership and levels of compliance or adoption among farmers.

Table 8. Level of SAS compliance and livelihood assets

Compliance Level	Livelihood Attainment Level			Chi-Square	Sig.
SOCIAL ASSETS					
Participation in farmer association	Decrease	Unchanged	Increase		
Low	6	45	59	35.73***	0.00
Moderate	6	26	142		
High	5	49	62		
Total	17	120	263		
Support from farmer groups or association	Decrease	Unchanged	Increase		
Low	8	48	54	29.45***	0.00
Moderate	8	30	136		
High	6	44	66		
Total	22	122	256		
Support to other family members	Decrease	Unchanged	Increase		
Low	10	44	56	17.38***	0.00
Moderate	6	38	130		
High	8	34	74		
Total	24	116	260		
Support to friends	Decrease	Unchanged	Increase		
Low	7	54	49	3.44	0.49
Moderate	8	71	95		
High	7	46	63		
Total	22	171	207		
Payment of funeral dues	Decrease	Unchanged	Increase		
Low	13	56	41	18.17***	0.00
Moderate	5	79	90		
High	6	41	69		
Total	24	176	200		
Payment of development dues	Decrease	Unchanged	Increase		
Low	6	59	45	11.47**	0.02
Moderate	5	83	86		
High	6	39	71		
Total	17	181	202		
Participation in naming ceremonies	Decrease	Unchanged	Increase		
Low	9	62	39	8.45*	0.08
Moderate	5	92	77		
High	7	51	58		
Total	21	205	174		

(*Continued*)

Table 8. (*Continued*)

Compliance Level	Livelihood Attainment Level			Chi-Square	Sig.
Participation in funerals	Decrease	Unchanged	Increase		
Low	10	55	45	5.83	0.21
Moderate	7	78	89		
High	6	49	61		
Total	23	182	195		
Participation in communal labour	Decrease	Unchanged	Increase		
Low	9	46	55	29.35***	0.00
Moderate	6	30	138		
High	7	42	67		
Total	22	118	260		
Trust in community leaders	Decrease	Unchanged	Increase		
Low	12	52	46	8.77*	0.07
Moderate	5	82	87		
High	7	50	59		
Total	24	184	192		
NATURAL ASSETS					
Yield per acre	Decrease	Unchanged	Increase		
Low	7	51	52	35.85***	0.00
Moderate	9	28	137		
High	5	46	65		
Total	21	125	254		
Quality of beans	Decrease	Unchanged	Increase		
Low	10	23	77	12.20**	0.02
Moderate	7	19	148		
High	6	11	99		
Total	23	53	324		
Cocoa farm size	Decrease	Unchanged	Increase		
Low	10	77	23	21.37***	0.00
Moderate	7	150	17		
High	7	76	33		
Total	24	303	73		
Number of farms	Decrease	Unchanged	Increase		
Low	8	72	30	13.39***	0.01
Moderate	11	144	19		
High	8	89	19		
Total	27	305	68		

(*Continued*)

Compliance Level	**Livelihood Attainment Level**			**Chi-Square**	**Sig.**
Number of Farm animals	Decrease	Unchanged	Increase		
Low	9	76	25	2.85	0.58
Moderate	15	132	27		
High	10	81	25		
Total	34	289	77		
FINANCIAL ASSETS					
Cocoa farm income	Decrease	Unchanged	Increase		
Low	13	43	54	28.67***	0.00
Moderate	8	34	132		
High	7	19	90		
Total	28	96	276		
Payment for labour	Decrease	Unchanged	Increase		
Low	10	48	52	15.77***	0.00
Moderate	9	63	102		
High	6	26	84		
Total	25	137	238		
Non-farm income	Decrease	Unchanged	Increase		
Low	13	70	27	26.60***	0.00
Moderate	36	120	18		
High	8	72	36		
Total	57	262	81		
Debt levels (formal and informal)	Decrease	Unchanged	Increase		
Low	26	63	21	64.61***	0.00
Moderate	98	74	2		
High	76	35	5		
Total	200	172	28		
Access to credit (formal and informal)	Decrease	Unchanged	Increase		
Low	10	61	39	2.79	0.59
Moderate	14	82	78		
High	8	61	47		
Total	32	204	164		
Savings levels (formal and informal)	Decrease	Unchanged	Increase		
Low	9	57	44	19.67***	0.00
Moderate	42	56	76		
High	14	54	48		
Total	65	167	168		

(*Continued*)

Table 8. (*Continued*)

Compliance Level	Livelihood Attainment Level			Chi-Square	Sig.
PHYSICAL ASSETS					
Ownership of knapsack machine	Decrease	Unchanged	Increase		
Low	9	36	65	5.84	0.21
Moderate	6	66	102		
High	7	54	58		
Total	22	153	225		
Ownership of mist blower	Decrease	Unchanged	Increase		
Low	8	42	60	59.54***	0.00
Moderate	24	125	25		
High	7	86	27		
Total	35	253	112		
Ownership of pruner	Decrease	Unchanged	Increase		
Low	5	44	61	81.63***	0.00
Moderate	9	145	20		
High	8	92	16		
Total	22	281	97		
Ownership of machete	Decrease	Unchanged	Increase		
Low	9	22	79	8.53*	0.07
Moderate	8	20	146		
High	11	22	83		
Total	28	64	308		
Ownership of baskets	Decrease	Unchanged	Increase		
Low	5	22	89	4.85	0.30
Moderate	9	21	144		
High	9	15	92		
Total	23	58	319		
Ownership of raffia mats	Decrease	Unchanged	Increase		
Low	6	37	67	15.99***	0.00
Moderate	7	29	138		
High	9	19	88		
Total	22	85	293		
Ownership of household appliance	Decrease	Unchanged	Increase		
Low	6	39	65	12.79**	0.01
Moderate	6	70	98		
High	7	24	85		
Total	19	133	248		
Ownership of harvesters	Decrease	Unchanged	Increase		

(*Continued*)

Compliance Level	**Livelihood Attainment Level**			**Chi-Square**	**Sig.**
Low	9	44	57	10.02**	0.04
Moderate	8	60	106		
High	6	59	51		
Total	23	163	214		
Ownership of a house	Decrease	Unchanged	Increase		
Low	7	56	47	19.27***	0.00
Moderate	5	115	54		
High	8	87	21		
Total	20	258	122		
HUMAN ASSETS					
Access to skilled labour	Decrease	Unchanged	Increase		
Low	5	52	53	39.64***	0.00
Moderate	8	30	136		
High	7	19	90		
Total	20	101	279		
Payment of wards' school fees	Decrease	Unchanged	Increase		
Low	10	50	50	35.73***	0.00
Moderate	9	49	117		
High	7	14	95		
Total	26	112	262		
Access to private extension	Decrease	Unchanged	Increase		
Low	12	52	46	37.40***	0.00
Moderate	8	32	134		
High	7	30	79		
Total	27	114	259		
Ability to register households on NHIS	Decrease	Unchanged	Increase		
Low	9	44	57	18.09***	0.00
Moderate	6	39	129		
High	6	25	85		
Total	21	108	271		
Access to COCOBOD extension services	Decrease	Unchanged	Increase		
Low	11	41	58	13.80***	0.01
Moderate	8	39	127		
High	6	39	71		
Total	25	119	256		

(*Continued*)

Table 8. (*Continued*)

Compliance Level	Livelihood Attainment Level			Chi-Square	Sig.
Access to unskilled labour	Decrease	Unchanged	Increase		
Low	8	54	48	8.25*	0.08
Moderate	10	61	103		
High	10	40	66		
Total	28	155	217		

Source: Field Survey, 2022.

Note; *** p < 0.01, ** p < 0.05, * p < 0.10.

In terms of natural assets, yield per acre, cocoa farm size, and the number of farms had a significant association with the compliance level of farmers at a 1% probability level. Equally, the quality of beans had a significant association with the compliance level of certified farmers at a 0.05 probability level. The results showed that farmers with higher yields per acre, larger farm sizes, and more farms were more likely to comply with SAS. This suggests that having access to more natural resources can positively influence farmers' ability to comply with SAS. Additionally, the quality of beans was also significantly associated with compliance levels. This implies that farmers who produce higher-quality beans are more likely to comply with SAS. This could be because higher quality beans fetch higher prices in the market, motivating farmers to adhere to sustainable farming practices that improve bean quality. The finding is supported by Anaglo et al. (2014) who found a significant association between farm size and the adoption of improved practices by farmers.

In terms of financial assets, there exists a significant association between certified cocoa farmers' compliance levels with cocoa farm income, payment for labour, non-farm income, debt levels (formal and informal) and savings levels (formal and informal) at a 0.01 probability value. Certified cocoa farmers with high levels of compliance were more likely to increase cocoa farm income, pay for labour, increase non-farm income, reduce debt and increase their savings. The results of the study suggest that financial assets play an important role in determining the compliance levels of certified cocoa farmers. The findings indicate that farmers with higher levels of compliance are more likely to have higher cocoa farm income, pay for labour, and increase non-farm income. This suggests that financial resources are essential in enabling farmers to comply with SAS. The study also found a significant relationship between debt levels and compliance levels. Farmers with high levels of compliance were more likely to have lower levels of debt, indicating that financially stable farmers may be better equipped to invest in sustainable production practices. Additionally, the study found a significant relationship between savings levels and compliance levels. Farmers with high levels of compliance were more likely to have higher levels of formal and informal savings, suggesting that financial stability and preparedness are important factors in enabling farmers to adopt sustainable practices and comply with certification standards. The findings are supported by Anaglo et al. (2017) who found that acceptance of current innovations was positively correlated with farmers' income, and savings.

In terms of physical assets, there is a significant association ($p < 0.01$) between the level of compliance with SAS and ownership of mist blower, ownership of a pruner, ownership of raffia mats, and ownership of a house. Again, a significant association ($p < 0.05$) was observed between the level of compliance with SAS and ownership of household appliances as well as ownership of harvesters. Finally, a significant association ($p < 0.1$) was observed between the level of compliance with SAS and ownership of machete. The results suggest that physical assets such as owning a mist blower, pruner, raffia mats, house, household appliances, harvesters, and machete have a significant association with the level of compliance among certified cocoa farmers. The

ownership of these assets may indicate that farmers have access to the necessary equipment and tools to carry out the recommended sustainable practices, such as pruning and weed management. Owning a mist blower and pruner may allow farmers to apply recommended fungicides and prune their farms respectively, both of which were found to have high levels of compliance. Similarly, ownership of raffia mats may allow for appropriate drying and fermentation of cocoa beans, which may result in higher quality beans and compliance with standards related to post-harvest handling. Ownership of a house and household appliances may indicate a higher level of economic well-being, which could enable farmers to invest more in their farms and comply with SAS. Anaglo et al. (2014) discovered a substantial tie among adopters of production practices in terms of the acquisition of household appliances and houses.

In terms of human assets, a significant relationship ($p < 0.01$) exists between the level of compliance and access to skilled labour, wards school fees payment, access to private extension, ability to register households on NHIS and access to COCOOBOD extension services. This implies that farmers with access to skilled labour, private extension services, and healthcare are likely to be more aware and knowledgeable about SAS, leading to higher compliance levels. Again, a significant relationship ($p < 0.1$) exists between the level of compliance and access to unskilled labour. This finding suggests that farmers who have access to a larger pool of unskilled labour may be more likely to engage in labour-intensive sustainable practices, such as weeding and pruning, resulting in higher compliance levels. The study's findings on the association between human assets and compliance level suggest that farmers with better access to human resources are more likely to comply with sustainable agricultural practices. Access to skilled labour, payment of ward school fees, access to private extension, and registration of households on NHIS were found to be significantly correlated with the degree of compliance at a 1% probability level. This finding is supported by Anaglo et al. (2014), Ntsiful (2010) and Anaglo et al. (2017) who found a significant relationship between the ability to pay ward's school fees and levels of adoption.

4. Conclusion and recommendation

The five (5) key sustainable practices certified smallholder cocoa farmers complied with are weed management strategies (manual) (76.5%), use of recommended fungicides (74.3%), use of recommended pesticides (69.3%), pruning of farm (68.8%) and appropriate weeding frequency (66.5%) while the two least complied sustainable practices were fertilizer application (17.8%) and provision of pesticide bath on farms (14.0%). Certified cocoa farmers' compliance was above average (i.e., 50% and above) for ten (10) out of the 14 recommended sustainable standards. Generally, 43.5% of the certified cocoa farmers complied moderately with the Sustainable Agriculture Standard. Land ownership, extension contact, and gender positively influenced certified cocoa farmers' compliance with SAS while support from LBC, access to credit, taking part in activities that generate cash outside of the farm, and farm size negatively influenced certified cocoa farmers' compliance with SAS. Certified cocoa farmers' compliance with SAS has a positive association with all their livelihood assets, thus, social assets, human assets, physical assets, financial assets and natural assets. The novelty of the paper lies in investigating the relationship between certified smallholder cocoa farmers' compliance with SAS and their livelihood assets. The study identified several determinants of farmers' compliance with SAS and found a significant association between compliance and livelihood assets. The findings of the paper can be used to inform policies and interventions aimed at improving the livelihoods of smallholder cocoa farmers in Ghana.

Based on the findings, the study recommends that efforts to promote non-agricultural income-generating activities among cocoa farmers must be balanced with efforts to promote and educate farmers on sustainable farming practices. There is a need to provide farmers with the necessary resources and support to effectively implement sustainable practices, regardless of their income sources. Farmer training should consider the time availability of all farmers, particularly women farmers as women may have limited time availability and social restrictions on where they can travel. Efforts to increase access to credit for cocoa farmers must be accompanied by efforts to promote and educate farmers on sustainable farming practices. It is suggested that a balanced

approach to support farmers should consider both short-term productivity and long-term sustainability. Policymakers and organizations involved in promoting sustainable agriculture should consider investing in social capital such as farmer groups, community participation, and social responsibility as a means of promoting compliance with recommended sustainable standards.

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Author details
Fred Ankuyi[1]
E-mail: fredankuyi@gmail.com
ORCID ID: http://orcid.org/0000-0002-9957-1350
Enoch Kwame Tham-Agyekum[1]
ORCID ID: http://orcid.org/0000-0003-1657-1409
Daniel Ankrah[2]
Akua Yeboah Oduro-Owusu[1]
John-Eudes Andivi Bakang[1]
David Boansi[1]
Solomon Asirifi[1]
[1] Department of Agricultural Economics, Agribusiness and Extension, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana.
[2] Department of Agricultural Extension, University of Ghana, Legon, Ghana.

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Note
1. Rainforest Alliance is a certification company established in 1986 to reduce commercial activities deteriorating the Amazon rainforest. RA began certifying farmlands in 1992 and is currently being utilised by almost two million farmers and thousands of industries in helping develop a world that can be sustained by protecting the environment and advancing the livelihoods of farmers. The RA's standards are centred on; climate, livelihood, human rights and forests (https://www.betterworldproducts.org/rainforest-alliance-certification/).

References
Aidoo, R., & Fromm, I. (2015). Willingness to adopt certifications and sustainable production methods among small-scale cocoa farmers in the ashanti Region of Ghana. *Journal of Sustainable Development*, *8*(1), 33–43. https://doi.org/10.5539/jsd.v8n1p33

Alliance, R. (2020). Rainforest Alliance sustainable agriculture standard Introduction.

Anaglo, J. N., Asare, C. J., Manteaw, S. A., & Boateng, S. D. (2017). Influence of improved Technology adoption on livelihoods of small ruminant farmers in Ghana. *Ghana Journal of Agricultural Science*, *51*, 73–82.

Anaglo, J. N., Boateng, S. D., Swanzy, F. K., & Felix, K. M. (2014). The influence of adoption of improved oil palm production practices on the livelihood assets of oil palm farmers in Kwaebibirem District of Ghana. *Journal of Biology, Agriculture and Healthcare*, *4*(1), 88–94.

Ankuyi, F., Tham-Agyekum, E. K., Aidoo, D. C., Bakang, J. E. A., Amankwa, K., Akowuah, A. K., & Makafui, W. T. (2022). Drivers of knowledge, attitude, practice, aspiration and perceptions of sustainable agriculture standard: Evidence from certified cocoa farmers in Ghana. *Russian Journal of Agricultural & Socio-Economic Sciences*, *11*(131), 111–120. https://doi.org/10.21776/ub.agrise.2023.023.1.14

Annor, P. B. (2018). Smallholder farmers' compliance with GlobalGAP standard: The case of Ghana. *Emerald Emerging Markets Case Studies*, 1–21.

Annor, B. P., Mensah-Bonsu, A., & Jatoe, J. B. D. (2016). Compliance with GLOBALGAP standards among smallholder pineapple farmers in Akuapem-South, Ghana. *Journal of Agribusiness in Developing and Emerging Economies*, *6*(1), 21–38. https://doi.org/10.1108/JADEE-05-2013-0017

Ansah, E. O., Kaplowitz, M. D., Lupi, F., & Kerr, J. (2020). Smallholder participation and procedural compliance with sustainable cocoa certification programs. *Agroecology & Sustainable Food Systems*, *44*(1), 54–87. https://doi.org/10.1080/21683565.2019.1579776

Antwi-Agyakwa, A. K., Osekre, E. A., Adu-Acheampong, R., & Ninsin, K. D. (2015). Insecticide use practices in cocoa production in four regions in Ghana. *West African Journal of Applied Ecology*, *23*, 39–48.

Arnould, E. J., Plastina, A., & Ball, D. (2009). Does fair trade deliver on its core value proposition? Effects on income, educational attainment, and health in three countries. *Journal of Public Policy & Marketing*, *28*(2), 186–201. https://doi.org/10.1509/jppm.28.2.186

Asamoah, M., & Owusu-Ansah, F. (2017). Report on land tenure & cocoa production in Ghana, a cocoa Research Institute of Ghana and World cocoa foundation collaborative Survey, Ghana

Baah, F., Anchirinah, V., & Amon-Armah, F. (2011). Soil fertility management practices of cocoa farmers in the eastern region of Ghana. *Agriculture & Biology Journal of North America*, *2*(1), 173–181.

Bandanaa, J., Asante, I. K., Egyir, I. S., Schader, C., Annang, T. Y., Blockeel, J., Kadzere, I., & Heidenreich, A. (2021). Sustainability performance of organic and conventional cocoa farming systems in Atwima Mponua District of Ghana. *Environmental and Sustainability Indicators*, *11*, 100121. https://doi.org/10.1016/j.indic.2021.100121

Boufous, S., Hudson, D., Carpio, C., & Marques, I. (2023). Farmers' willingness to adopt sustainable agricultural practices: A meta-analysis. *PLOS Sustainability and Transformation*, *2*(1), e0000037. https://doi.org/10.1371/journal.pstr.0000037

Boyd, C., & McNevin, A. (2015). *Aquaculture, resource use, and the environment*. John Wiley & Sons. https://doi.org/10.1002/9781118857915

Brako, D. E., Richard, A., & Alexandros, G. (2021). Do voluntary certification standards improve yields and well-being? Evidence from oil palm and cocoa smallholders in Ghana. *International Journal of Agricultural Sustainability*, *19*(1), 16–39. https://doi.org/10.1080/14735903.2020.1807893

Bray, J. G., & Neilson, J. (2017). Reviewing the impacts of coffee certification programmes on smallholder livelihoods. *International Journal of Biodiversity Science, Ecosystem Services & Management*, *13*(1), 216–232. https://doi.org/10.1080/21513732.2017.1316520

Chiputwa, B., Spielman, D. J., & Qaim, M. (2015). Food standards, certification, and poverty among coffee farmers in Uganda. *World Development*, *66*, 400–412. https://doi.org/10.1016/j.worlddev.2014.09.006

Denkyirah, E. K., Okoffo, E. D., Adu, D. T., & Bosompem, O. A. (2017). What are the drivers of cocoa farmers' choice of climate change adaptation strategies in Ghana?. *Cogent Food & Agriculture*, *3*(1), 1334296. https://doi.org/10.1080/23311932.2017.1334296

Deppeler, A., Fromm, I., & Aidoo, R. (2014). The unmaking of the cocoa farmer: Analysis of benefits and challenges of third-party audited certification schemes for cocoa producers and laborers in Ghana. In *International Food and Agribusiness Management Association (IFAMA) 2014 Symposium, Cape Town, South Africa.*

Dragusanu, R., Giovannucci, D., & Nunn, N. (2014). The economics of fair trade. *Journal of Economic Perspectives*, *28*(3), 217–236. https://doi.org/10.1257/jep.28.3.217

Famuyiwa, B. S., Aroyenu, S. O., Adeyemi, E. A., Okeniyi, M. O., Agbongiarhouyi, A. E., & Yahaya, A. T. (2018). Farmers knowledge, attitude and practice of cocoa certification in Southwest Nigeria. *Journal of Agricultural Extension*, *22*(1), 18–29. https://doi.org/10.4314/jae.v22i1.3S

Fenger, A. N., Skovmand Bosselmann, A., Asare, R., & de Neergaard, A. (2017). The impact of certification on the natural and financial capitals of Ghanaian cocoa farmers. *Agroecology & Sustainable Food Systems*, *41*(2), 143–166. https://doi.org/10.1080/21683565.2016.1258606

Fountain, A., & Hütz-Adams, F. (2020). *The cocoa barometer 2020*. Voice Network.

Gideon, D. A. (2010). *Empirical Analysis Of Productivity And Resource-Use-Efficiency In Ghana's Cocoa Industry: Evidence From Bibiani-Anhiawso-Bekwai District* (Doctoral dissertation).

Greene, W. H. (2008). The econometric approach to efficiency analysis. *The Measurement of Productive Efficiency and Productivity Growth*, *1*(1), 92–250.

Hando, H., Senapathy, M., Bojago, E., & Xiao, X. (2022). Determinants of member Participation in activities of multipurpose primary cooperatives: The case of Kindo Koysha District, Southern Ethiopia. *Advances in Agriculture*, *2022*, 1–21. https://doi.org/10.1155/2022/3569016

Herman, F., Arsyad, M., & Karim, I. (2020). Performance analysis of cocoa certification program in Polewali mandar regency. *ANJORO: International Journal of Agriculture and Business*, *1*(1), 1–6. https://doi.org/10.31605/anjoro.v1i1.641

ICCO. (2020). *Quarterly bulletin of cocoa statistics*.

Iddrisu, M., Aidoo, R., & Wongnaa, C. A. (2020). Participation in UTZ-RA voluntary cocoa certification scheme and its impact on smallholder welfare: Evidence from Ghana. *World Development Perspectives*, *20*, 100244. https://doi.org/10.1016/j.wdp.2020.100244

Ingelmo, F., Molina, M. J., de Paz, J. M., & Visconti, F. (2011). Soil saturated hydraulic conductivity assessment from expert evaluation of field characteristics using an ordered logistic regression model. *Soil and Tillage Research*, *115*, 27–38. https://doi.org/10.1016/j.still.2011.06.004

Ingram, V. J., Waarts, Y. R., Ge, L., van Vugt, S. M., Wegner, L., & Puister-Jansen, L. F. (2014). *Impact of UTZ certification of cocoa in Ivory Coast. Assessment framework and baseline*. LEI Wageningen UR.

Jena, P. R., Chichaibelu, B. B., Stellmacher, T., & Grote, U. (2012). The impact of coffee certification on small-scale producers' livelihoods: A case study from the Jimma Zone, Ethiopia. *Agricultural Economics*, *43*(4), 429–440. https://doi.org/10.1111/j.1574-0862.2012.00594.x

Kasente, D. (2012). Fairtrade and organic certification in value chains: Lessons from a gender analysis from coffee exporting in Uganda. *Gender & Development*, *20*(1), 111–127. https://doi.org/10.1080/13552074.2012.663627

Kassem, H. S., Alotaibi, B. A., Aldosari, F. O., Herab, A., & Ghozy, R. (2021). Factors influencing smallholder orange farmers for compliance with GobalGAP standards. *Saudi Journal of Biological Sciences*, *28*(2), 1365–1373. https://doi.org/10.1016/j.sjbs.2020.11.070

Konlan, S., Quaye, A. K., Pobee, P., Amon-Armah, F., Dogbatse, J. A., Arthur, A., Fiakpornu, R., & Dogbadzi, R. (2019). Effect of weed management with glyphosate on growth and early yield of young cocoa (theobroma cacao L.). *African Journal of Agricultural Research*, *14*(28), 1229–1238. https://doi.org/10.5897/AJAR2018.13555

Lescuyer, G., & Bassanaga, S. (2021). Positive influence of certification on the financial performance of cocoa production models in Cameroon. *Frontiers in Sustainable Food Systems*, *5*, 743079. https://doi.org/10.3389/fsufs.2021.743079

Lipschutz, R. D. (2015). Environmental regulation, certification and corporate standards: A critique. In P. Dauvergne (Ed.), *Handbook of global environmental politics* (pp. 218–232). Edward Elgar Publishing Limited.

Liu, T., Bruins, R. J., & Heberling, M. T. (2018). Factors influencing farmers' adoption of best management practices: A review and synthesis. *Sustainability*, *10*(2), 432. https://doi.org/10.3390/su10020432

Masson, C. (2011). *An assessment of farmers' livelihood in the coffee certification Schemes in Tanzania* [Doctoral dissertation]. University of Nairobi).

Mendez, V. E., Bacon, C. M., Olson, M., Petchers, S., Herrador, D., Carranza, C., & Mendoza, A. (2010). Effects of fair trade and organic certifications on small-scale coffee farmer households in Central America and Mexico. *Renewable Agriculture and Food Systems*, *25*(3), 236–251. https://doi.org/10.1017/S1742170510000268

Millard, E. (2011). Incorporating agroforestry approaches into commodity value chains. *Environmental Management*, *48*(2), 365–377. https://doi.org/10.1007/s00267-011-9685-5

Muhongayire, W., Hitayezu, P., Mbatia, O. L., & Mukoya-Wangia, S. M. (2013). Determinants of farmers' participation in formal credit markets in rural Rwanda. *Journal of Agricultural Sciences*, *4*(2), 87–94. https://doi.org/10.1080/09766898.2013.11884706

Mulwa, C., Marenya, P., Rahut, D. B., & Kassie, M. (2017). Response to climate risks among smallholder farmers in Malawi: A multivariate probit assessment of the role of information, household demographics, and farm characteristics. *Climate Risk Management*, *16*(1), 208–221. https://doi.org/10.1016/j.crm.2017.01.002

Mushobozi, W. L. (2010). Good Agricultural practices on horticultural production for extension staff in Tanzania.

Mwangi, M., & Kariuki, S. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics & Sustainable Development*, *6*(5), 208–216.

Nelson, V., Opoku, K., Martin, A., Bugri, J., & Posthumus, H. (2013). *Assessing the poverty impact of sustainability standards: Fairtrade in Ghanaian cocoa*. DfID UK.

Ntsiful, A. (2010). *Outgrower oil palm plantations scheme by private companies and poverty reduction in Ghana* [A PhD. thesis dissertation].

Ogola, T. D. O., Lagat, J., Kosgey, I. S., Ogola, T. D., Lagat, J. K., & Kosgey, I. S. (2015). Factors influencing smallholder dairy farmers participation in voluntary compliance of decent work practices: Case study in Nakuru county Kenya. *International Journal of Humanities and Social Science*, *5*(3), 57–63.

Olufemi, A., Babatunde, A., Olaniyi, O., Adewale, A., Osasogie, U., Idrisu, M., & Adeleke, S. (2020). Evaluation of herbicides and manual weed control methods in the establishment of theobroma cacao L. in Cross River state of Nigeria. *World Journal of Advanced Research & Reviews*, *8*(1), 298–306. https://doi.org/10.30574/wjarr.2020.8.1.0368

Olutegbe, N. S., & Sanni, A. O. (2021). Determinants of compliance to good Agricultural practices among cocoa farmers in Ondo state, Nigeria. *Caraka Tani: Journal of Sustainable Agriculture*, *36*(1), 123. https://doi.org/10.20961/carakatani.v36i1.44894

Opoku-Ameyaw, K., Baah, F., Gyedu-Akoto, E., Anchirinah, V., Dzahini-Obiatey, H. K., Cudjoe, A. R., Acquay, S., & Opoku, S. Y. (2010). *Cocoa manual—A source book for sustainable cocoa production*. Cocoa Research Institute of Ghana.

Owombo, P. T., Idumah, F. O., & Afolayan, A. F. (2014). Assessing factors affecting adherence to safety precautions in pesticides use among cocoa farmers in Nigeria. *Ethiopian Journal of Environmental Studies and Management*, *7*(2), 810–820. https://doi.org/10.4314/ejesm.v7i2.1S

Oyetunde Usman, Z., Olagunju, K. O., & Ogunpaimo, O. R. (2021). Determinants of adoption of multiple sustainable agricultural practices among smallholder farmers in Nigeria. *International Soil & Water Conservation Research*, *9*(2), 241–248. https://doi.org/10.1016/j.iswcr.2020.10.007

Pandit, U., Nain, M. S., Singh, R., Kumar, S., & Chahal, V. P. (2017). Adoption of good Agricultural practices (GAPs) in basmati (scented) rice: A study of prospects and retrospect. *Indian Journal of Agricultural Sciences*, *87*(1), 36–41. https://doi.org/10.56093/ijas.v87i1.66998

Parikhani, M. P., Borkhani, F. R., Fami, H. S., Motiee, N., & Hosseinpoor, A. (2015). Major barriers to application of good Agricultural practices (GAPs) technologies in sustainability of livestock units. *International Journal of Agricultural Management and Development*, *5*(3), 169–178. https://doi.org/10.5455/ijamd.161640

Paschall, M., & Seville, D. (2012). Certified Cocoa: scaling up farmer participation in West Africa. *Case study series, new business models for sustainable trading relationships*, 28.

Pongvinyoo, P. (2015). *Development of Good Agricultural Practices (GAP) in Thailand: A case study of Thai National GAP selected products* [Doctoral dissertation]. Hiroshima University.

Quartey, C. L. N. K., Mensah, J. O., Nimoh, F., Adams, F., & Etuah, S. (2021). Choice of certification schemes by smallholder pineapple farmers in Ghana: Analysis of constraints and determinants of adoption. *Journal of Agribusiness in Developing and Emerging Economies*, *13*(1), 141–155. https://doi.org/10.1108/JADEE-02-2021-0046

Ramcilovic-Suominen, S., & Hansen, C. P. (2012). Why some forest rules are obeyed and others violated by farmers in Ghana: Instrumental and normative perspective of forest law compliance. *Forest Policy and Economics*, *23*, 46–54. https://doi.org/10.1016/j.forpol.2012.07.002

Ruben, R., & Fort, R. (2012). The impact of fair trade certification for coffee farmers in Peru. *World Development*, *40*(3), 570–582. https://doi.org/10.1016/j.worlddev.2011.07.030

Ruben, R., Fort, R., & Zúñiga-Arias, G. (2009). Measuring the impact of fair trade on development. https://doi.org/10.1080/09614520903027049

Rueda, X., & Lambin, E. F. (2013). Responding to globalization: Impacts of certification on Colombian small-scale coffee growers. *Ecology and Society*, *18*(3). https://doi.org/10.5751/ES-05595-180321

Rusli, A. L., & Fatah, F. A. (2022). A review on the participation of cocoa smallholders in agricultural certification scheme. *IOP Conference Series: Earth and Environmental Science*, *1114*(1), 012018. IOP Publishing. https://doi.org/10.1088/1755-1315/1114/1/012018

Sarea, A. M., Muslih, A. M., & Iqbal, T. H. (2017). Measuring the level of compliance with financial accounting standard No. 8: Evidence from Bahrain. In *Proceedings of the Global Conference on Business and Economics Research (GCBER)*, Universiti Putra Malaysia, Malaysia (pp. 14–15).

Sasidharana, L., & Menéndez, M. (2014). Partial proportional odds model - an alternate choice for analyzing pedestrian crash injury severities. *Accident Analysis & Prevention*, *72*, 330–340. https://doi.org/10.1016/j.aap.2014.07.025

Som, S., Burman, R. R., Sharma, J. P., Sangeetha, V., Lenin, V., Iquebal, M. A., & Thoke, N. J. (2017). Assessment of stakeholders' knowledge and attitude towards good agricultural practices for grapes. *Indian Journal of Agricultural Sciences*, *87*(2), 273–277. https://doi.org/10.56093/ijas.v87i2.67674

Sowunmi, F. A., Famuyiwa, G. T., Oluyole, K. A., Aroyeun, S. O., & Obasoro, O. A. (2019). Environmental burden of fungicide application among cocoa farmers in Ondo state, Nigeria. *Scientific African*, *6*, e00207. https://doi.org/10.1016/j.sciaf.2019.e00207

Tetteh Anang, B., Sipiläinen, T. A. I., Bäckman, S. T., & Kola, J. T. S. (2015). Factors influencing smallholder farmers' access to agricultural microcredit in Northern Ghana. *African Journal of Agricultural Research*, *10*(24), 2460–2469. https://doi.org/10.5897/AJAR2015.9536

Tlusty, M. F., & Tausig, H. (2015). Reviewing GAA-BAP shrimp farm data to determine whether certification lessens environmental impacts. *Reviews in Aquaculture*, *7*(2), 107–116. https://doi.org/10.1111/raq.12056

Tosto, A., Zuidema, P. A., Goudsmit, E., Evers, J. B., & Antena, N. P. R. (2022). The effect of pruning on yield of cocoa trees is mediated by tree size and tree competition. *Scientia Horticulturae*, *304*, 111275. https://doi.org/10.1016/j.scienta.2022.111275

Tyler, T. R. (2006). *Why people obey the law*. Princeton University Press.

Utting, K. (2009). Assessing the impact of fair trade coffee: Towards an integrative framework. *Journal of Business Ethics*, *86*(Suppl 1), 127–149. https://doi.org/10.1007/s10551-008-9761-9

Vellema, W., Casanova, A. B., González, C., & D'Haese, M. (2015). The effect of specialty coffee certification on household livelihood strategies and specialisation. *Food Policy*, *57*, 13–25. https://doi.org/10.1016/j.foodpol.2015.07.003

Waarts, Y., Ingram, V., Linderhof, V., Puister-Jansen, L., van Rijn, F., & Aryeetey, R. (2015). *Impact of UTZ certification on cocoa producers in Ghana, 2011 to 2014 (No. 2015-066)*. LEI Wageningen UR.

Wigfield, A., & Cambria, J. (2010). *Expectancy-value theory: Retrospective and prospective.In* The decade ahead: Theoretical perspectives on motivation and achievement. Emerald Group Publishing Limited.

Wongnaa, C. A., Bakang, J. E., Asiamah, M., Appiah, P., & Asibey, J. K. (2021). Adoption and compliance with council for scientific and industrial research recommended maize production practices in Ashanti region, Ghana. *World Journal of Science, Technology and Sustainable Development*, *18*(4), 438–456. https://doi.org/10.1108/WJSTSD-03-2021-0035

Yahaya, A. M., Karli, B., & Gül, M. (2015). Economic analysis of cocoa production in Ghana: the case of eastern region. *Custos e@ gronegócio on line*, *11*(1), 336–352.

Yiridomoh, G. Y., Bonye, S. Z., & Derbile, E. K. (2022). Assessing the determinants of smallholder cocoa farmers' adoption of agronomic practices for climate change adaptation in Ghana. *Oxford Open Climate Change*, *2*(1), 005. https://doi.org/10.1093/oxfclm/kgac005