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COOPERATIVE MEMBERSHIP STATUS AND ADOPTION OF GOOD AGRONOMIC PRACTICES: EMPIRICAL EVIDENCE FROM COCOA FARMERS IN ATWIMA MPONUA DISTRICT, GHANA

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ABSTRACT

The study examined cooperative membership status and adoption of good agronomic practices (GAPs) among cocoa farmers in the Atwima Mponua District of Ashanti Region, Ghana. Data was collected from 400 cocoa farmers selected using the multistage sampling technique. Statistical analytical tools such as mean, standard deviation, frequency, percentage, ordered logit regression model, independent samples t-test and chi-square test of independence were used. The study showed a high level of awareness, knowledge, and skills on GAPs among the farmers. Membership status (active and non-active) was found to have a statistically significant association with adoption of GAPs. Gender, household size, age of farmer and access to extension services were the other factors that influenced adoption of GAPs. There was a statistically significant difference in yields and income of active and non-active members. The study recommends that the Ghana Cocoa Board (COCOBOD) should develop a policy that could enable it to continue to work with only cooperatives. Also, existing cooperatives should be empowered to encourage active participation by all members to ensure that more GAPs are continually adopted. This can also result in higher yields and income.

Keywords: Adoption, Cocoa Farmers, Cooperative Society, GAPs, Membership Status

I. INTRODUCTION

Social capital is a collective asset in the form of shared norms, values, beliefs, trust, networks, social relations, and institutions that facilitate cooperation and collective action for mutual benefits. It largely influences career success, helps influence inter-unit resource exchange and product innovation, motivates the combination and exchange of intellectual capital, enhances communication, promotes higher organizational survival chances, and influences inter-firm learning (Blekking *et al.,* 2021; Ko, 2021; Pereira *et al.,* 2020). Further development on social capital led to the establishment of several emerging cooperative societies (Tsekpo, 2008).

Cooperation has always been fundamental for human society and plays a prominent role in rural and agricultural development. Farmers in Ghana participated in collective activities even before farmer organisations were established (Onumah *et al.,* 2007; Tsekpo, 2008). According to Ostrom (2004) and Wanyama *et al.,* (2008), a cooperative society is an autonomous association of people

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who have come together voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled business. Cooperatives are founded on the principles of self-reliance, democracy, equality, equity, and solidarity. One of the key activities of cooperative societies is the assistance they give to their members on the implementation of GAPs.

GAPs are a collection of principles to apply for on-farm production and postproduction processes resulting in safe and healthy food and non-food agricultural products while considering economic, social, and environmental sustainability (Vijayakumar *et al.,* 2021). A GAP approach to agriculture includes the development of guidelines or standards for agricultural producers and post-farm handlers, the monitoring of these standards, and the transmission of these standards to downstream companies, customers, and the public through reliable quality signals (Kolavalli & Vigneri, 2011; Peprah, 2004).

Generally, GAPs in cocoa include pruning, farm sanitation, appropriate use of fertilizer and agrochemical use and good drying and storage of cocoa beans, etc. GAPs in cocoa also encompass the production of safe cocoa beans essential for protecting consumers from the hazards of foodborne illnesses and increasing competitiveness in export markets (Bymolt *et al.,* 2018). If correctly managed, cocoa plantation followed by GAPs may generate a lot of money. Farmers should embrace and apply GAPs in farming to enhance product quality, minimize the impact of non-tariff barriers, and cultivate more environmentally friendly crops (Chaurasiya *et al*., 2018; Gayi and Tsowou, 2016).

It has been documented that implementation of GAPs encourages promotion of optimum use of resources such as pesticides, fertilizers, water, and eco-friendly agriculture (Leon *et al.,* 2022; Xu *et al.,* 2021). Furthermore, some GAPs aim to improve farm management and production decisions in poor nations to enhance or stabilize yields. This also helps producers to stabilize and/or increase their revenue stream (Baral, 2021). Crop losses are reduced and the available quantity of product for family use and market is increased (Raheel *et al.,* 2021; Vijayakumar *et al*., 2021).

In cooperative societies, the social aspects such as acceptance and group dynamics have a crucial influence in farmer decision-making and the diffusion of relevant information concerning GAPs. The proximity and level of confidence in the source of information influences agricultural decisions, which must strike a balance between fresh knowledge, trust, shared beliefs, and experience (Ranjbar *et al*., 2021). Adoption of agricultural innovations is critical for guaranteeing food security and poverty reduction by potentially improving farm household income and lowering market prices for staple foods (Abdoulaye *et al.,* 2014; World Bank 2008).

Consumer consciousness of health matter, coupled with heightened environmental awareness, has led to a growing interest in GAP commodities. This gives farmers the required motivation and entry point to take advantage of competitive markets to boost their farm profits and better their living conditions (Pakdeetrakulwong & Hengpraprohm, 2018).

An important part of any cooperative organisation is its members and their active participation in and loyalty to the cooperative are vital for its success. If members' participation is limited to economic patronage only, a cooperative society will be no different than any of the other business units. Farmers participate in agricultural cooperatives to overcome barriers such as poverty, market failure, missing services in the production process, decreased income, increased transaction costs with trades and contribution to community development (Dale *et al*., 2013; World Bank, 2001).

Numerous studies have sought to gain insights into the influence of cooperatives on farmers' decision-making in connection with GAPs. For instance, Adeogun *et al.,* (2010) and Afolami *et al.,* (2015) asserted that the inefficiencies of farmers (poor yields and low income) and the lack of adoption of cost-effective agriculture technologies can significantly be reduced by encouraging farmers to join cooperative societies. It is also an established fact that extension workers tend to operate more efficiently with groups of farmers rather than individual holders (Abdoulaye *et al.,* 2014; Asfaw, 2010; Gebremariam *et al.,* 2021). Moreover, a cooperative is the only form of business organization that addresses fully all the economic, democratic, and social dimensions of poverty reduction (Woldu *et al.,* 2013). Other empirical studies show that agricultural cooperatives improve farm productivity through their influence on the adoption of technological innovations (Abebaw & Haile, 2013; Adams *et al.,* 2021; Blekking *et al.,* 2021; Manda *et al.,* 2020) and by improving farm productivity (Abate *et al.,* 2014). This improvement in agricultural productivity is important for enhancing farmer livelihood, reducing rural poverty, and increasing food security (Ndlovu & Masuku, 2021; Shiferaw *et al.,* 2014; Uddin *et al.,* 2020). Among other things, information and knowledge about innovations spread more quickly within a cooperative compared with individual farmers and this enhances confidence about innovative practices and helps facilitate a more efficient implementation and application. Also, better access to credit for members of cooperatives compared with their low-income individual counterparts and availability of funds has a positive correlation with a higher rate of the adoption of innovations (Kehinde *et al.,* 2018; Ofori *et al.,* 2019; Simmons, 2008). However, there are also cases where collective actions did not improve farmers' situation (Poulton *et al.,* 2010).

All these previous studies looked at the relevance of agricultural cooperatives in producing viable outcomes such as adoption of innovations, access to credit, farm productivity, poverty reduction, food security etc. In terms of measurement of membership status, the focus was largely on members and non-members. Moreover, the focus of most of such studies was the food crop sector (maize, rice, cassava, etc.) while largely ignoring cash crops such as cocoa. There are currently limited studies on cooperative membership status (active and non-active) and good agronomic practices especially for the cocoa industry. This research study seeks to fill this gap. The paper contributes to the growing literature on the role of agricultural cooperatives in five major directions. First, it will provide insights into the level of awareness, knowledge, attitude, and skills of cocoa farmers on GAPs. Secondly, it will establish the adoption rate of GAPs between active and non-active cooperative members. Thirdly, it will determine the extent of association between cooperative membership status and adoption of GAP. It will also look at the other factors, aside membership status that influence adoption of GAPs. Finally, it will compare the yield and income of the active and non-active members.

II. MATERIAL AND METHODS

The study was carried out in Atwima Mponua District of Ashanti Region. The population of Atwima Mponua Cocoa District was estimated to be 119,180 representing 2.5 percent of the region's total population (GSS, 2010). This study used the multi-stage sampling technique. In the first stage, the simple random sampling was used in selecting the district. In the second stage, ten (10) operational areas were selected from the 32 operational areas using the simple random sampling technique. In the third stage, a simple random sampling technique was also used to select 40 farmers from their farmers' groups which comprised both active members and non-active members. In total, 400 members (involving active and non-active members) were selected from the 10 operational areas as determined using the sample size formula by Yamane (1973). This was done so that every member (whether active or non-active) will be presented with an

equal and independent chance of being selected. The balloting method was employed to conduct the simple random sampling technique in the four stages. With this method, a list of the cooperative members was obtained from the leaders and selection made through the ballots by the researchers. In order to know the active and non-active methods, leaders assisted researchers to identify them after the data collection. This was done on the basis of payment of monthly dues and attendance to meetings. At the end, 210 active members and 190 non-active members were identified.

This research was mainly based on primary data. Standardized structured questionnaire was used through a face to face to collect quantitative data from the farmers within the selected operational areas in the district. To get accurate data from the selected farmers, they were assured of their confidentiality during fieldwork by contracted. Cooperative leaders were first contacted to get a list of their members; active and non-active. Interviews were held at the morning and evening hours of the day and in the homes of the farmers when they were present and relaxed. This occurred from 28th May to 18th July 2021. Data was analysed using SPSS (version 21) and Stata.

The socio-economic characteristics of cocoa farmers and their awareness, knowledge, attitude, and skills) were analysed using descriptive statistics (means, standard deviations, frequencies, and percentages). To compare the adoption rate of GAPs between active and non-active cooperative members, descriptive statistics were used. Farmers were asked if they had applied any of the specified GAPs on their farms before. Responses were then used to group farmers into the different adoption levels such as high, medium, and low adopters. Those classified as low were those who had adopted up to 24 of the specific GAP items. Those classified as moderate were those who had adopted between 25 or 26 of the specific GAP items while high represented those who had adopted fully (all the 27 GAP items). To analyse the extent of association between cooperative membership status (active and non-active) and adoption of GAPs, the Chi-square test of independence was used.

In order to determine the other factors that influence adoption of GAPs, the ordered logit regression model was used. The study used ordered logit model to investigate and determine the effect of descriptive variables such as education, age, gender, marital status, farm size etc. on adoption of GAPs. It is a model in which the observable dependent variable 'Y' has j = 0, 1, 2, ..., k ordered scales and it is used to explain the relationship between variables when the dependent variable is categorical. This method is also categorized among consecutive categories, from low to high values (low adoption, moderate adoption and high adoption). The explanatory variables consisted of continuous, categorical and ordinal variables and there was no multi-collinearity. The analysis used the link function to explain the effects on the explanatory ordinal categorical variable, without the normality and homogeneity assumption of variances. The ordinal logistic regression model assumed that the relationship between the explanatory variable and the ordered categorical variable is categorically independent, since the ordered categorical variable of the regression coefficient is not tied to the categorical (Chen & Hughes, 2004).

The model is as follows:

$$LogitYi = \beta o + \beta iXi + \cdots + \varepsilon i$$

Where, *Y*i: adoption of GAPs; it can take values 0 (low), 1 (moderate), 2 (high), which represents the number of GAPs adopted; βo = When the arguments take a value of zero; βi: Vector of parameters that should be estimated; *X*i: factors [(Gender= Male-1, Female-0, Dummy); (Household size= Number of persons in household, Ordinal); (Age=Years, Continuous); (Education=Number of years spent in school, Ordinal); (Religion= Christian-1, Other Religions-

0, Dummy); (Farmer status=Farm owner-1, Others-0, Dummy); (Farm size=Acres, Continuous; Farm age=Years), (Ordinal; Access to extension=Access-1, No access-0, Dummy); (Access to credit= Access-1, No access-0, Dummy); (Marital status=Married-1, Not married-0, Dummy)]; e: Residual error which is logistically distributed.

Finally, to compare the yield and income of active and non-active members, the independent samples t-test was used. The mean figures were used as the basis for the t-test calculation.

III. RESULTS AND DISCUSSION

3.1 Socio-economic characteristics of respondents

Table 1 above summarizes the socio-economic characteristics of the farmers (continuous variables) such as age, household size, farm size and farm age.

Table 1: Socio-economic characteristics of respondents (Continuous variables)

Variables	Unit of measurement	Mean	Std. Dev	Min.	Max.
Age	Years	54.01	8.97	19	73
Household size	Number	4.65	1.45	2	9
Farm size	Acreage	11.54	5.66	4	38
Farm age	Years	13.74	7.99	4	48

Source: Field Data, 2021

From the table, the average age of the cocoa farmers was 54 years. A maximum age of 73 was recorded for the farmers while 19 years was the lowest age among the farmers. Similarly, Amfo *et al.,* (2021) found the mean age of cocoa farmers to be 53 years. This means that a greater proportion of the cocoa farming populations are adults. These could be considered as embodiments of indigenous knowledge on good agronomic practices in cocoa production and who have possibly gathered years of experience in cocoa production. The average household size of the farmers was five (5), with nine (9) being the highest and two (2) being the lowest. With 5 (five) being the average household size among the cocoa farmers, it study shows that the cocoa farmers have a relatively large household size. Awoyemi *et al.,* (2019) commented on household size of farmers and asserted that big rural farm families have a ready supply of labour for planting and other farming techniques that might encourage expansion of farms. An average farm size of 12 acres was recorded for the farmers. The maximum farm size was 38 acres while the minimum farm size was 4 acres. The average farm age of the farmers was estimated at 14 years, with forty-eight (48) years being the maximum farm age and four (4) years being the minimum.

Table 2 also presents the socio-economic characteristics of respondents (discrete variables); marital status, membership status, gender, religion, educational level, farmer status, access to extension services, access to credit.

Majority of the respondents (86.25%) were married. Only 4.0% were single while only 9.75% were those either divorced or widowed. Concerning membership, active were found to be 53% while the non-active members were 47%. Out of 400 cocoa farmers interviewed most of them were males (68.25%) and 31.75% were females. Majority of the respondents interviewed were Christians (76.50%), followed by Muslims (20.75%) and 2.75% of the farmers attended other religions excluding traditional worshippers. Those with primary education constituted the highest percentage (64.75%) of the respondents. About 9.75% had no formal education, 3.0% of the farmers had Senior High School (SHS) Certificates, 22.25% of them had Junior High School Certificates and only a small fraction of the respondents (0.25%) had tertiary education.

Generally, the farmers' level of education is relatively high and encouraging. This indicates that most of them possess a foundation in formal education which can help the farmers appreciate the relevance of cooperative societies and at the same time influence their adoption levels of GAPs. This result is in line with other studies that also agree that education is central to cooperative development (Dung, 2020; Zhang *et al.,* 2019).

Table 2: Socio-economic characteristics of respondents (Discrete variables)

Variables	Frequency	Percentage (%)
Marital status		
Married	345	86.25
Divorced	13	3.25
Single	16	4.00
Widowed	26	6.50
Membership Status		
Active Member	210	52.50
Non-Active Member	190	47.50
Gender		
Male	273	68.25
Female	127	31.75
Religion		
Christianity	306	76.50
Muslim	83	20.75
Others	11	2.75
Educational Level		
No formal education	39	9.75
Primary	259	64.75
JHS	89	22.25
SHS	12	3.00
Diploma/HND	1	0.25
Degree	-	-
Farmer Status		
Farm owner	330	82.50
Caretaker	62	15.50
Lease/Rent	4	1.00
Abunu (share cropping; 50/50)	4	1.00
Access to Extension Service		
Yes	390	97.50
No	10	2.50
Access to credit		
Yes	236	59.00
No	164	41.00

Source: Field Data, 2021

The table also shows that majority (82.50%) of the cocoa farmers were farm owners, 15.50% were caretakers while 1% each were leased farmers or those practicing 'abunu' (share cropping; 50/50). Almost all the cocoa farmers (97.50%) interviewed had access to extension services with only 2.50 % not having access to extension services. On the farmers' responses to credit access, 59.0% of them had access to credit through personal savings (50.42%), cooperatives (12.29%), banks (13.98%) and friends (21.0%) whilst 41.0% did not have access to credit. According to the study conducted by Agbo (2009), about 60.5% of the respondents who belonged to cooperative societies got access to extension and various sums of money as credit through the cooperatives.

In that same study, 14.52% of them bought farm inputs at subsidized prices while 25% were assisted by the cooperatives to sell their farm produce.

3.2 Farmers awareness, knowledge, skills and attitude towards GAPs

In terms of awareness, the results in Table 3 shows that cocoa tree pruning (100%), and mulching (100%) had a high level of awareness, followed by weed management (99.75%), nursery management (99.50%) and shade management/tree cover (99.50%) with the right pod harvesting time (99.25%), mistletoes management (99.0%), fertilizer application (99.0%), pest control/integrated pest management (99.0%) aerobic and anaerobic fermentation (99.0%) and proper drying (99.0%). From the results, it could be said that cocoa farmers had their highest awareness in cocoa tree pruning and mulching while their lowest knowledge was in proper drying.

Table 3: Farmers awareness, knowledge skills and attitude on GAPs

GAPs	Awareness		Knowledge		Skills		Attitude		
	Yes	No	Yes	No	Yes	No	Disagree	Neutral	Agree
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Nursery management	398 (99.5)	2 (0.50)	392 (98)	8 (2)	371 (92.75)	29 (7.25)	9 (2.25)	48 (12)	343 (85.75)
Shade management/tree cover	398 (99.5)	2 (0.50)	399 (99.75)	1 (0.25)	394 (98.50)	6 (1.50)	4 (1)	36 (9)	360 (90)
Cocoa tree pruning	400 (100)	-	400 (100)	-	387 (96.75)	13 (3.25)	-	39 (9.75)	361 (90.25)
Mistletoes management	396 (99)	4 (1)	397 (99.25)	3 (0.75)	396 (99)	4 (1)	-	16 (4)	384 (96)
Mulching	400 (100)	-	400 (100)	-	397 (99.25)	3 (0.75)	6 (1.50)	3 (0.75)	391 (97.75)
Weed management	399 (99.75)	1 (0.25)	398 (99.50)	2 (0.50)	391 (97.75)	9 (2.25)	5 (1.25)	18 (4.50)	377 (94.25)
Fertilizer application	396 (99)	4 (1)	396 (99)	4 (1)	395 (98.75)	5 (1.25)	4 (1)	21 (5.25)	375 (93.75)
Pest control/integrated pest management	396 (99)	4 (1)	395 (98.75)	5 (1.25)	392 (98)	8 (2)	5 (1.25)	1 (0.25)	394 (98.50)
Right pod harvesting time	397 (99.25)	3 (0.75)	394 (98.50)	6 (1.50)	395 (98.75)	5 (1.25)	4 (1)	8 (2)	388 (97)
Aerobic and anaerobic fermentation	396 (99)	4 (1)	395 (98.75)	5 (1.25)	394 (98.5)	6 (1.50)	6 (1.5)	4 (1)	390 (97.50)
Proper drying	396 (99)	4 (1)	396 (99)	4 (1)	392 (98)	8 (2)	5 (1.25)	2 (0.50)	393 (98.25)

Source: Field Data, 2021

In terms of knowledge, the results show that cocoa tree pruning (100%) and mulching (100%) had a high level of knowledge, followed by shade management/tree cover (99.75%), weed management (99.50%), mistletoes management (99.25%), fertilizer application (99%), proper drying (99%), aerobic and anaerobic fermentation (98.75%), pest control/integrated pest management (98.75%), right pod harvesting time (98.50%), nursery management (98%). From the results, it could be said that cocoa farmers had their highest knowledge in pruning and mulching while their lowest knowledge was in nursey management. There was a high level of awareness among the cocoa farmers on the GAPs. As stated by Amon-Armah *et al.,* (2021), awareness is a significant stage in the adoption process. This could well be a good step in the development of knowledge and skills as it contributes to the rate of the adoption process. Djuideu

et al., (2021) highlight the need for cocoa farmers to follow best management practices such as pruning to aid vigorous growth. It is also recommended to reduce shade to allow air to move above and between cocoa trees. Pruning trees on a regular schedule improves tree health, controls growth, and enhances flowering, fruiting and appearance. Mulching covers the soil and prevents weeds from germinating, it helps to hold and retain soil moisture, keeps the soil cooler in hot weather, provides the soil with nutrient and protects the soil against erosion (Ali & Sari, 2021). It is therefore not surprising that cocoa farmers had full awareness/knowledge of pruning and mulching as a good agronomic practice.

In terms of skills, the result shows that mulching (99.25%) and mistletoes management (99%) had the highest level of skills followed by fertilizer application (98.75%), right pod harvesting time (98.75), shade management/tree cover (98.50%), weed management (97.75%), pest control/integrated pest management (98%), aerobic and anaerobic fermentation (98.5%), proper drying (98%), cocoa tree pruning (96.75%) and nursery management (92.75%). From the results, it could be said that cocoa farmers had their highest skills in mulching while their lowest skill was in nursey management. In a study by Awoyemi *et al.,* (2019) on the assessment of the use of cocoa production management practices among cocoa farmers in Nigeria, it was found that the planting of plantain was rather a major management practice (M=2.84) used by cocoa farmers in the study area. Other practices confirmed by this study included pruning, regulated and planned to cut of trees, slashing and brushing of weeds underneath cocoa tree, minimum tillage, use of shade trees, spraying of chemical to control of pest and diseases. In that study, mulching was of lesser usage in the study area.

Farmers were also asked about their attitude towards GAPs using a three-point Likert scale (1 = disagree to 3 =agree). In terms of attitude, pest control/integrated pest management (98.50%) scored the highest. This was followed by proper drying (98.25%), mulching (97.75%), aerobic and anaerobic fermentation (97.50%), right pod harvesting time (97%), mistletoes management (96%), weed management (94.25%), fertilizer application (93.75%), cocoa tree pruning (90.25%), shade management/tree cover (90%) and nursery management (85.75%). From the results above, it could be said that in terms of attitude, cocoa farmers agreed most with pest control/integrated pest management while nursey management had the lowest.

Having awareness, knowledge and skills promotes demand or adoption of specific GAPs (Amon-Armah *et al.,* 2021). While most of the farmers were abreast (awareness, knowledge, and skills) with the GAPs recommended by the COCOBOD, they seemed to lack relevant knowledge, skills, and positive attitude towards nursery management. It is well understood that nursery management is both cumbersome and tedious. Because of this, COCOBOD has mounted a host of nurseries within the country to help cocoa farmers. It is where most cocoa farmers purchase their seedlings for planting. Although this is a good attempt by the COCOBOD to assist farmers scale this hurdle, it is also playing to the disadvantage of not encouraging farmers to learn the practice of nursery management. For instance, in the case where seedlings have already been purchased by farmers, those who come in late will not be able to purchase. Eventually, it may reduce access to seedlings and production will also be affected. According to Asare and Sonii (2010), a reliable source of planting material (i.e., seed source) and water are required in close proximity to where the nursery is to be sited. This could be the reason why cocoa farmers prefer to purchase the seedlings from COCOBOD nurseries than establishing their own nurseries.

3.3 Adoption rate of gaps between active and non-active cooperative members

Table 4 presents the result of farmers' responses to some specific GAPs statements. The responses were grouped according to active and non-active members.

Table 4: Adoption of GAPs by active and non-Active members

GAPs	Active Members		Non-Active Members	
	Yes (N/%)	No (N/%)	Yes (N/%)	No (N/%)
Depended on own farm for beans for nursery establishment	60 (28.57)	150 (71.43)	67 (35.26)	123 (64.74)
Depended on other farm for beans for nursery establishment	82 (39.05)	128 (60.95)	80 (42.11)	110 (57.89)
Acquired certified bean for nursery establishment	176 (83.81)	34 (16.19)	155 (81.58)	35 (18.42)
Pruned overgrown tree branches	210 (100)	-	190 (100)	-
Removed undesirable trees from farm	210 (100)	-	190 (100)	-
Planted desirable trees to provide shade	209 (99.52)	1 (0.48)	187 (98.42)	3 (1.58)
Applied granular fertilizer in the raining season	210 (100)	-	190 (100)	-
Applied 3 bags of granular fertilizer per acre	210 (100)	-	190 (100)	-
Applied foliar fertilizer in the morning or sunset	187 (89.05)	23 (10.95)	161 (84.74)	29 (15.26)
Removal of basal chupons	210 (100)	-	190 (100)	-
Removal of lateral chupons	210 (100)	-	190 (100)	-
Removal of overhanging branches	210 (100)	-	190 (100)	-
Removed and properly disposed cocoa tree plant parasites	210 (100)	-	190 (100)	
Protect tree base with organic covering to conserve moisture	210 (100)	-	190 (100)	-
Used weedicides to control weeds	210 (100)	-	190 (100)	-
Slashed farm to control weeds	210 (100)	-	190 (100)	-
Animals grazed under plantation to control weeds	190 (90.48)	20 (9.52)	165 (86.84)	25 (13.16)
Sprayed two tanks of recommended COCOBOD pesticide per acre	197 (93.81)	13 (6.19)	158 (83.16)	32 (16.84)
Use of neem extract or organic pesticide to control pests	207 (98.57)	3 (1.43)	183 (96.32)	7 (3.68)
Harvested pods every 3-4 weeks	210 (100)	-	186 (97.89)	4 (2.11)
Carefully harvested pods away from flower cushion	210 (100)	-	190 (100)	-
Removed damaged and fungi infested pods during harvesting	210 (100)	-	190 (100)	-
Properly disposed fungi infested pods to reduce disease spreading	210 (100)	-	190 (100)	-
Use plantain/banana leaves to ferment beans	210 (100)	-	180 (94.73)	10 (5.26)
Turned over beans twice before fermentation was completed on the 6th day	210 (100)	-	164 (86.32)	26 (13.68)
Cleaned drying mat before next drying of cocoa beans	210 (100)	-	190 (100)	-
Mold beans removed during drying	210 (100)	-	190 (100)	-

Source: Field Data, 2021

From Table 4, almost all the farmers, both active members and non-active members of cooperative society responded Yes to the GAPs statements being mentioned to them. However, the statements with the lowest scores by both active and non-active members were on statements around nursery management. For instance, about 29% and 35% each of active and non-active members depended on own farm for beans for nursery establishment. About 39% and 42% each of active and non-active members depended on other farm for beans for nursery establishment. About 84% and 82% each of active and non-active members acquired certified bean for nursery establishment. On nursery management practices, Asare and Sonii (2010) explained that for smallholder cocoa farmers, a temporary nursery will be appropriate for raising small quantities of seedlings, suitable for a household. They recommended permanent nurseries for raising large quantities of seedlings, for commercial use. Therefore, the intended purpose of the seedlings will

determine the type of nursery to establish. The membership status (active and non-active members) and adoption levels of respondents is presented in Table 5.

Table 5: Membership status (active and non-active members) and adoption levels of respondents

Adoption level	Active Members N (%)	Non-Active Members N (%)
Low (23-24)	20 (9.52)	40 (21.05)
Moderate (25-26)	179 (85.24)	146 (76.84)
High (27)	11 (5.24)	4 (2.11)

Source: Authors Computation, 2021
Pearson $chi^2 = 12.31$; $P < 0.05$

A careful observation of Table 5 shows that both active and non-active members had a moderate level of the adoption rate of GAPs. However, the active members scored higher than non-active members. From the Table, active members of cooperative societies also recorded the highest adoption rate of GAPs (5.24%) as compared to non-active members of cooperative societies (2.11%). This relative difference could be due to majority of the farmers enjoying some extra services from being members of cooperative societies. Agriculturally based cooperatives have means or ways of equipping their farmers with GAPs. This result supports the studies of Kehinde (2021) that cooperative membership enhances the intensity of good farm practices or new technology adoption than non-members.

The Chi-square test of independence was used to test the association between membership status and level of adoption. The results as presented in Table 5 revealed that there is a statistically significant association between membership status and adoption level of GAPs ($p<0.05$). This means that there is a relationship between membership status and level of adoption of GAPs. The implication is that for any advancement to be made in GAPs adoption among cocoa farmers, the cooperative system could be a safe platform to be used. Cocoa farmers need to be encouraged to become active members of their cooperatives since it could help them to adopt the relevant technologies that could boost their farming activities. This result is confirmed by the findings of Kehinde (2021) asserting that cooperative membership significantly increases the number of technologies adopted by smallholder farmers.

3.4 Other factors that influence GAP adoption

This hypothesis was tested by Chi-square test, the assumption of parallelism ($p < 0.05$) was provided as statistically significant, and the null hypothesis was accepted (Table 6). Since $P < 0.05$, it means that for the parameter estimation values, the dependent variable passes over all the categories on the same line. This means that Ho hypothesis is accepted and H1 hypothesis is rejected. Table 7 shows the goodness-of-fit test for the model.

Table 6: Test of Parallel Linesa

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	378.50			
General	356.54	21.96	12	0.00

Ho=The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.
a. Link function: Logit.

Table 7: Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	342.98	123	0.00
Deviance	344.24	123	0.00

H_0 = Model data is suitable; H1 = Model data is not suitable.
Cox and Snell R^2=0.09; Nagelkerke R^2=0.10; McFadden R2=0.05
Link function: Logit.

As shown in Table 7, the model's suitability is determined using the difference between the observed and expected values of the model. Therefore, it was assumed that the model was in agreement with the assumption that $p < 0.05$ as statistically significant and that the null hypothesis was accepted. The R^2 values of the model are calculated, showing how many percent of the dependent variable is explained by the independent variables. However, these values do not give definite results.

Table 8: Other factors that influence GAP adoption

Variables	Coefficient	Std. Err.	Wald	P>|z|	[95% Conf. Interval]	
[adoption = low (1)]	2.96	0.13	6.86	0.01	0.74	5.15
[adoption = moderate (2)]	3.72	0.14	10.76	0.00	1.49	5.95
[adoption = high (3)]	1.98	0.75	7.01	0.01	0.52	3.46
Gender	0.86	0.33	7.09	0.01*	0.23	1.50
Household size	0.22	0.47	6.49	0.01*	0.28	2.16
Age	0.05	0.04	1.27	0.06***	-0.03	0.12
Education	0.01	0.04	0.06	0.95	-0.08	0.09
Religion	-0.01	0.02	-0.20	0.84	-0.05	0.04
Farmer status	0.04	0.03	2.14	0.14	-0.01	0.10
Farm size	0.01	0.02	0.17	0.84	-0.03	0.04
Farm age	-0.01	0.01	-0.21	0.83	-0.01	0.01
Access to extension service	0.04	0.12	0.75	0.04*	-0.05	0.11
Access to credit	0.01	0.02	0.18	0.86	-0.04	0.01
Marital status	-0.01	0.02	-0.75	0.45	-0.05	0.02
Farming experience	-.007	.010	.497	0.48	-.028	.013
Constant	-0.79	0.49	2.20	0.01	-0.01	-0.06

Source: Authors' Computation, 2021
NB: *1%, **5%, ***10% Sig level

In the study, the ordered logit regression analysis was applied to figure out the other determinants of adoption of GAP. Results of this analysis are given in Table 8. The p values in the Table help to understand the significance level of the explanatory variables included in the model. The coefficients of the variables in the table were examined. Correspondingly, it was determined that gender ($p<0.01$), household size ($p<0.01$), age ($p<0.1$) and access to extension services ($p<0.05$) were the other factors that positively and significantly influence farmers' adoption of GAPs. This suggests that as gender, household size, age and access to extension services increase, their adoption of GAPs increases and vice versa.

A positive coefficient can be observed in gender. According to the results of this study, males are more likely to adopt GAPs than females. This implies that the business of cooperatives has become the preserve of males who are not constrained in resource and time to adopt innovations. Doss and Morris (2001) agree that male-headed households are rather more likely to adopt new technologies compared to female- headed households. Again, males are likely to adopt GAPs

because these come with their own skill sets and strengths which can only be performed by the males (Karamba & Winters, 2015).

Age of farmer had a positive significant influence on farmers' adoption of GAPs. This suggests that as farmers' age increases, they adopt more. This may be on the grounds that very experienced farmers have gained adequate training and skills in their occupation and have also established adequate working conditions (Bernard *et al.*, 2008; Abebaw & Haile, 2013). Household size also had a positive significant influence on farmers' adoption of GAPs.

Access to extension services had a positive significant influence on farmers' adoption of GAPs. Cooperatives solve members' issues through the provision of extension services to aid members in their production process. Hence, farmers who have gotten various trainings in agricultural related activities are bound to adopt GAPs. Within the cooperatives, they gain access to information and extension support services. Extension services provide major crucial extension functions such as helping farmers to form producer groups, transferring new technologies to farmers, and training them to diversify their farming systems through using sustainable production methods and practices. In addition, access to extension services puts farmers in a better position of adopting new ways of farming and GAPs (Wanyama et al., 2008). This result supports the studies of Zakaria et al., (2020) that agricultural extension has been the most essential source of information to farmers in most African countries and plays a substantial part in influencing farmers' adoption of modern technologies.

3.5 Farm outcomes of active and non-active members

Table 9 shows the farm outcomes of active and non-active members in terms of yield and income were compared. In terms of yield, it was realised that active members had a mean yield of 195 bags per season while the non-active members had a mean yield of 72 bags per season. In terms of income, it was realised that active members had a mean income of 13,483 GHC per season while the non-active members had a mean yield of 10,289 GHC per season. Table 10 shows the independent samples t-test of yield and income between active and non-active members.

Table 9: Farm outcomes

Membership Status	N	Yield (bags)			Farm Income (GHC)		
		Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean
Active Members	210	194.65	69.97	4.83	13,482.57	8,611.74	594.27
Non-Active Members	190	72.39	48.09	3.49	10,289.26	10,307.90	747.81

Source: Field Data, 2021

The independent samples t-test was used to test whether there was a significant difference between active and non-active members in terms of their yield and income. The Levene's test for equality of variances was significant in both yield and income. A statistically significant difference between the yield and income of the active and non-active members was found ($p<0.05$). This means that the active members of the cooperative societies had more yield and income than the non-active members. Membership level of activeness or commitment in cooperatives is for a reason. According to Byrne and McCarthy (2005), it is based on "cold calculation of costs and benefits. It is a matter of relative evaluation – a preference for something offered by the co-operative as compared to other service providers. This can be associated with

product (such as yield) and financial results (such as farm income). These are expected to result in commitment or activeness (Österberg and Nilsson, 2000).

Table 10: Independent samples T-Test (Yield/Income)

		Levene's Test for Equality of Variances	t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Yield	Equal variances assumed	62.11	0.00	20.16	398	0.00	122.25	6.07	110.33	134.18
	Equal variances not assumed			20.52	372.04	0.00	122.25	5.96	110.54	133.97
Income	Equal variances assumed	0.72	0.04	3.37	398	0.00	3193.31	946.71	1332.14	5054.48
	Equal variances not assumed			3.34	369.74	0.00	3193.31	955.18	1315.03	5071.58

Source: Authors Computation, 2021

IV. CONCLUSION

Most of the cocoa farmers displayed high levels of awareness, knowledge, skills, and had positive attitudes towards the GAPs recommended by COCOBOD. However, they seemed to lack relevant knowledge, skills, and attitudes towards nursery management. Access to extension service was found to be a significant factor in increasing adoption of GAPs. The study recommends that community extension agents must be encouraged and empowered to organise training programmes in all GAP areas especially in nursery management so that farmers will not be overly dependent on COCOBOD nurseries.

Gender, household size, age of farmer and access to extension services are the other factors that influence adoption of GAPS. The study recommends that farmers who are females, have relatively small household sizes, young in age and have no access to extension services must be targeted and encouraged to adopt GAPs since it will eventually affect their yields and incomes.

Both active and non-active members had a moderate level of the adoption rate of GAPs. However, active members of cooperative societies recorded the highest adoption rate of GAPs as compared to the non-active members of cooperative societies. Membership status had an association with level of adoption of GAPs. Active members also had more yields and income than the non-active members. The implication is that for any advancement to be made on GAP adoption among cocoa farmers, the cooperative system could be a safe platform to be used. Cocoa farmers need to be encouraged by the Government and other relevant stakeholders through COCOBOD to become active members of their cooperatives since it could help them to adopt the relevant technologies that could boost their farming activities. COCOBOD should develop a policy that could enable it to continue to work with only cooperatives to ensure that more GAPs are continually adopted. Cocoa farmers who are yet to join cooperative societies also need to be encouraged to join so that they could enjoy the numerous benefits it comes with.

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