

Full Length Research Paper

Determinants of small scale farmers' decision to join farmer based organizations in Ghana

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In recent times, governments of most developing countries have been promoting the formation and development of farmer based organizations as one of the keys to more rapid diffusion and cost-effective extension delivery to farmers. This is premised on the assumption that small-scale farmers can have easy access to market information, credit and input for their production, processing, and marketing activities by joining farmer based organizations. However, this study found out that despite such observed benefits, some farmers were not members of farmer based organizations. This study uses the probit model to assess the factors influencing the decisions to join farmer based organizations in Ghana. The results revealed that farm size, farming as a major occupation, access to credit to loan and access to machinery services influenced farmers' decisions to join farmer based organizations in the Eastern Region of Ghana.

Key words: Farmer-based organizations, probit model, decision-making process

INTRODUCTION

Ghana's agriculture predominantly consists of smallholder individual farmers, constituting about 90% of Ghanaian farmers (AgSSIP, 2005). However, these farmers are disadvantaged in accessing certain information such as access to credit and other inputs relevant to their production, processing, and marketing activities (AgSSIP, 2005). In view of this, the Ministry of Food and Agriculture has taken steps over the years to develop farmer based organizations (FBOs) at the grassroot level and register them at the local, district, and regional groupings to a national apex. This is expected to give FBOs power to bargain (FASDEP II, 2007).

Also, reports by Osei-Asibe (2004) and Timpo (2001) indicate that the closer the farmer is to the leadership of a farmer organization, the greater the patronage. Most of the FBOs in the Akwapim South municipality are locally based, therefore, the membership is expected to be high. With the inception of the Millennium Development

Authority (MiDA) programme which aims at commercializing FBOs, membership of FBOs are expected to increase rapidly. This is because farmers have reasonable access to credit/loans which enable them to increase both output and productivity.

Farmer based organizations (FBOs) now increasingly voice the needs of their members in various fora on policy-making and orienting service provision. They are solicited by the private sector to enhance chain development, including those for new markets, and they play a role in local development planning. FBOs are now more than ever, actively involved in agricultural development, which requires institutional, organizational and technological innovation in order to be successful. Providing user-oriented research, extension and training services is therefore a prerequisite for technological innovation. Institutionalizing participatory methods, decentralizing services, creating multi-actor platforms, and multi-stakeholder driven funding mechanisms all enhance demand-driven agricultural services.

By examining factors influencing decision to join FBOs in Ghana, this study comes in handy with the quest for such an understanding. Joining an FBO is said to occur when the individual enlists with an FBO, attend meetings regularly, and pays dues. Although FBOs provide several

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Abbreviations: FBOs, Farmer based organizations; DTJ, decision to join, MiDA, millennium development authority.

services such as access to information, access to inputs, access to loans, access to machinery services among others, yet, some farmers are not members of any FBO. Just as the case of any innovation or technology, small-scale farmers will take several factors into consideration before opting to join FBOs. It is therefore important for policy makers, non governmental organizations and development partners to understand these factors and their effect on farmers' decisions to join FBOs. This study is very important because it sheds light on the important factors that directly or indirectly influence farmers to join FBOs. Such information is useful for policy makers, donor agencies and the Ghana government in several respects. The Directorate of Agricultural Extension Services of the Ministry of Food and Agriculture and other stakeholders in the extension service delivery needs such information to formulate policies that ensure that more farmers join FBOs, so as to make the delivery of extension services more rapid and cost effective. The results from the study are also useful to farmers as it will emphasize on some of the potential benefits that they can obtain by mobilizing themselves into groups to access input services, credit and marketing services that will enable them increase their yield, bargaining power and income, thereby improving their livelihoods.

METHODOLOGY

This study was conducted in the Eastern region of Ghana specifically in the Akuapim South municipality. There are about 39 FBOs in the municipality who are mainly into production, marketing and processing of their produce. Again, this municipality falls under the Southern intervention zone, one of the three intervention zones by the Millennium Development Authority (MiDA) for the commercialization of FBOs in the country.

Data was collected by the use of well structured questionnaires through interviews. A simple random sample of 20 FBOs was selected from the municipality. For each of the selected FBO visited, a minimum of 4 respondents were interviewed, in addition, 4 other respondents who are not members of that particular FBO and at the same time not members of any other FBO were also selected using the same sampling technique and interviewed. In effect, a total of 160 respondents were interviewed, 80 of them are members of an FBO and 80 are not members of any FBO. The variables included respondents' age, level of education, household size, primary occupation, access to credit, machinery services, farm income, and non-farm income. Data was analysed using version 3.1 of the computer based Econometric Views software (E-Views)

Analytical framework

The individual's decision to join FBOs is dichotomous, involving two mutually exclusive alternatives. The individual either joins the FBO or does not. Models for estimating such phenomena in which the dependent variable is binary have been propounded. The framework for such analysis has its root in the threshold theory of decision making in which a reaction occurs only after the strength of a stimulus increases beyond the individual's reaction threshold (Hill and Kau, 1981). This implies that every individual when faced with a choice has a reaction threshold influenced by several factors. The

individual either joins the FBO or does not. This yields a binary dependent variable, y_i which takes on the values of zero (not joining an FBO) and one (joining an FBO). The probability of observing a value of one is:

$$P_r(y_i = 1) = \frac{1}{x_i \beta_i} = 1 - F(-x_i \beta_i) \quad (1)$$

where F is a cumulative distribution function, it is a continuous, strictly increasing function that takes a real value and returns a value which ranges from 0 to 1. Then, it follows that the probability of observing the zeros is:

$$P_r(y_i = 0) = F(-x_i \beta_i) \quad (2)$$

Given such a specification, we determine the parameters for estimating this model using the maximum likelihood estimation approach. The dependent variable is an unobserved latent variable that is linearly related to y_i by the equation:

$$y_i = \beta_i x_i + u_i \quad (3)$$

Where u_i is a random disturbance term. The observed dependent variable is determined by whether y_i exceeds a threshold value or otherwise:

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases} \quad (4)$$

where y_i^* is the threshold value for y_i and is assumed to be normally distributed. Common models for estimating such parameters include probit (standard normal), logit (logistic) and tobit (extreme value) (Madala, 2005).

The model

The study adopted the probit model partly because of its ability to constrain the utility value of the decision to join variable to lie within 0 and 1, and its ability to resolve the problem of heteroscedasticity. Following from Madala (2005), the probit model adopted for the study is specified as:

$$P_i = P(y_i^* < y_i) \\ P_i = P(y_i^* < \beta_0 + \beta_i X_{ji}) = F(y_i) \\ P_i = F(y_i) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z_i} e^{-\frac{s^2}{2}} ds \quad (5)$$

where F_i is the probability that an individual will make a certain choice (join an FBO or not); s is a random variable normally distributed with mean zero and unit variance; y_i^* is the dependent variable (decision to join); y_i is the threshold value of the dependent variable.

To obtain an estimate of the index Z_i , the inverse of the cumulative normal function is used:

$$y_i = F^{-1}(P_i) = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_n x_{in} + u_i \quad (6)$$

The parameters $\beta_0, \beta_1, \beta_2, \beta_3, \dots, \beta_n$ of the probit model do not provide direct information about the effect of the changes in the explanatory variables on the probability of joining alone. The relative effect of each explanatory variable on the likelihood that a farmer will join an FBO is given by:

$$\frac{\partial P_i}{\partial x_{ij}} = \beta_{ij} * f(Z_i) \quad (7)$$

where P_i is the mean dependent variable whose value is given in the probit results as:

$$f(Z_i) = F^{-1}(P_i) \quad (8)$$

The elasticity of the predicted probability is then computed as:

$$\frac{\partial P_i}{\partial x_{ij}} = \beta_{ij} * f(Z_i) * \frac{\overline{X}}{P_i} \quad (9)$$

Guided by related studies (Ayamga, 2006; Hodinott, 1992; Nzomoi, 2007), socio-economic attributes were identified and hypothesis constructed regarding the individual's decision to join an FBO. The socio-economic factors either had a bearing on the individual (farmer), or on the FBO, and hence, associated policies. The variables include age, gender (sex), level of education, access to loans/credit, access to machinery services, household size, farming as a major occupation, access to extension services, experience, and farm size.

A dummy variable was used to specify sex of respondents. In Ghana, males are usually heads of households and their influence on household decision is paramount. Thus, males are more likely to join FBOs as compared to females. A value of 1 was assigned to males and 0 to females. If this is true, the sex variable is expected to be significant. The level of education of respondents is expected to have a positive influence on the decision to join an FBO. A person with formal education is expected to have adequate knowledge on the importance of belonging to an association and is more likely to join FBOs. Education was grouped into different levels: primary (EDUC0), secondary (EDUC1), junior high (EDUC2), senior high (EDUC3) and tertiary (EDUC4). Each of these variables was dummied.

Larger households spend more on food and other household needs. The higher expenditure associated with larger households sizes tend to make them more resource constrained and hence the need for external support. It is thus expected that as household size increases, the tendency of the household to join FBOs also increases. Age is represented by AGE and AGE². Many research works have found a negative relationship between age and decision to join or adopt (Gockowski and Ndoumbe, 2004; McBride and Daberkow, 2003; and Gamba et al., 2002). The hypothesis here is that the use of farm information sources decreases with increase in

age of farmers, which means that young farmers are more alert to obtaining information from sources that discuss several ways of improving their vocation than older farmers which they believe will have access to such varying sources by joining FBOs. In addition, past experiences of older farmers could make them complacent, thus discouraging them from joining the FBOs.

Many researchers have found a positive relationship between decision to join farmer groups and access to credit (Nzomoi et al., 2007; Mussei et al., 2001; Grigoryan et al., 2002; Negatu and Parikh, 1999). The hypothesis is that credit enables farmers, even those in low-income groups, to overcome their financial constraint and adopt innovations involving some cost. Most financial institutions do not lend to farmers because of the risky nature of farming, and even those who do, will demand for collaterals which the farmers cannot afford individually. They however prefer to lend to farmers in groups. Hence, access to credit is expected to have a positive effect on farmers' decision to join FBOs.

Access to farm machinery has a positive effect on farmers' decision to join FBOs (Sabates-Wheeler, 2002; Grigoryan et al., 2002). The implication is that, the cost of agricultural machinery especially tractor and other implement is so high that the small scale farmer cannot afford to purchase outright. However, as a group, farmers can acquire these equipment since suppliers of these equipment will be more willing to give to a group rather than an individual small holder farmer. The variable MACHN is used to represent farmers' access to machinery services and is expected to be positive. Farmers who take farming as their primary occupation may tend to concentrate most of their efforts into it hence are more likely to join FBOs. The coefficient of the variable OCCU is expected to be positive. The variable FRMSZE is used to represent farm size and it defines the effective land area (in hectares) under cultivation and not total land area. Most researchers have found a positive relationship between farm size and decision to join or adopt (Adimado, 2001; Kheralla et al., 2001; Langyintuo and Mekuria, 2005). The hypothesis here is that farmers with larger cultivated areas mostly cultivate for commercial purposes and will tend to be interested in issues that concerns their farming activities and will lead to increased yield and income. In addition, by joining FBOs, it will enable them to receive some support such as access to credit, extension services market information, etc. Other studies such as Mussei et al. (2001), and Gockowski and Ndoumbe (2004) found a negative relationship between farm size and decision to join or adopt. The coefficient of this variable can be either positive or negative.

Many researchers have found a negative relationship between nonfarm income and decision to join a farmer group or adopt a given technology (Feder et al., 1985; Mussei et al., 2001; Krishna and Qaim, 2006). The hypothesis is that farmers with higher non farm incomes tend to concentrate less of their time and efforts in farming activities and thus, will be less likely to join farmer groups but rather, other groups that are not farmer based. Thus the coefficient of non farm income is expected to be negative. The empirical model is specified as:

$$y_i = \beta_0 + \beta_1 AGE + \beta_2 AGE^2 + \beta_3 SEX + \beta_4 OCCU + \beta_5 HHSIZE + \beta_6 FRMSZE + \beta_7 LOAN + \beta_8 MACHN + \beta_9 EDUC2 + \beta_{10} NONFINC + \beta_{11} FINCM + v_i \quad (10)$$

The dependent variable y_i is the farmers decision to join an FBO or otherwise, and it takes the value of 1 if the farmer joins the FBO and 0 if he/she does not.

RESULTS AND DISCUSSION

The probit model employed to estimate the effect of

Table 1. Description of explanatory variables used in the model.

Variable	Unit of measure	Frequency/(mean)
Age of respondents	Years	41.29
Sex of respondents	Binary variable	0=50;1=110
Primary occupation (farming)	Binary variable	0 =120;1 = 40
Household size	Number of persons	5.89
Farm size	Hectares	2.96
Access to Credit/loan	Binary variable	0=9;1=152
Access to machinery services	Binary variable	0=37;1=123
Income	Ghana Cedis	3061.98

Table 2. Probit estimates of factors influencing decision to join an FBO.

Variable	Coefficient	Std. error	z-statistic	Prob.
AGE	1.853098**	0.888736	2.085093	0.0371
AGE_AGE	-0.015499*	0.008062	-1.922612	0.0545
OCCU	2.090717 ^{ns}	1.453257	1.438642	0.1503
FARMSIZE	1.017844**	0.499210	2.038912	0.0415
HHSIZE	-0.477582 ^{ns}	0.472240	-1.011312	0.3119
SEX	1.390141 ^{ns}	1.650585	0.842211	0.3997
LOAN	10.22539***	4.987129	2.050357	0.0043
MACHINERY	4.397573*	2.400668	1.831812	0.0670
INCOME	0.000676**	0.000316	2.138694	0.0325
CONSTANT	30.46162	17.64226	1.726628	0.0842
Mean dependent var.	0.500000	S.D. dependent var		0.501570
Log likelihood	-4.994728	Hannan-Quinn criter.		0.265479
LR statistic (9 df)	211.8176	Avg. log likelihood		-0.031217
Probability(LR stat)	0.000000	McFadden R-squared		0.954963
Obs with Dep=0	80	Total obs		160
Obs with Dep=1	80			

*, ** and ***: Significant at 10, 5 and 1% respectively; ns: not significant.

factors influencing farmers' decision to join farmer based organizations had ten explanatory variables. The variable for experience in farming (EXP) and number of extension contacts (EXT) were dropped because they rendered all the other variables insignificant. Table 1 presents a description of the explanatory variables used in the model.

From the results in Table 2, a likelihood ratio (LR) statistic of 211.8176 with a χ^2 distribution at 9°of freedom was significant at less than 1%. This means that at least one of the variables in the model has a significant effect on farmers' decision to join FBOs and that the explanatory variables jointly influence the farmers' decision to join farmer based organizations. With the exception of household size, all the explanatory variables were found to be in conformity with the priori expectations. The coefficient of the square of age (AGE²) and access to machinery (MACHN) were significant at 10% probability level; the coefficient of age (AGE), farm size (FRMSZE) and income (INCOME) were significant at

5% and the coefficient of access to loan (LOAN) was significant at 1%.

The coefficients of the remaining variables as household size (HHSIZE), primary occupation (OCCU) and sex (SEX) were all not significant at 10%. Hence, we do not reject the null hypotheses. The age of the farmer had a positive significant effect on the decision to join an FBO. However, when age was squared, the effect became negative and significant. The implication here is that younger farmers are more likely to join FBOs and this likelihood of becoming a member of an FBO increases with age. Increasing the age of the farmer by 1 year increases the likelihood of joining an FBO by 73.63% (Table 5). However, the older the farmer gets, the less likely he/she is to join. Beyond this point, increasing age decreases the likelihood of joining an FBO. Both age variables were elastic.

From the earlier discussions, it is seen that the decision to join increases with age, however, as the farmer gets older, his decision to join decreases with increase in age.

Table 3. Age groupings of respondents.

Group name	Age group	Frequency	Percent
AGE1	< 20	8	5
AGE2	20-30	21	13.1
AGE3	31-40	64	40.0
AGE4	41-50	55	34.4
AGE5	51-61	12	7.5

Table 4. Probit estimates of DTJ model for the age groupings.

Variable	Model
AGE1	0.2121097 ^{ns}
AGE2	0.0151312 ^{ns}
AGE3	0.2068625*
AGE4	0.2319212*
AGE5	-0.2080447*
Mean dependent variable	0.50000
LR statistics	19.45915
Probability	0.001578
Log likelihood	-101.1740
McFadden R-squared	0.087730
Observations with Dep=0	80
Observations with Dep=1	80
Total observation	160

Values presented are the marginal effects; *, ** and ***: Significant at 10, 5 and 1% respectively; ns: not significant; Dependent variable is the DTJ (yes = 1, no = 0).

To investigate further the particular age at which the decision to join begins to decrease with age, farmers were grouped into six equal percentiles and five of these were regressed on the decision to join variable. However, these groups were the only regressors considered for the analyses. The various age groups considered are presented in Table 3. The age groupings AGE1, AGE2, AGE3 AGE4 and AGE5 were regressed in the 'on the decision to join (DTJ)'. Result from the analysis is presented in Table 4.

It could be observed from the model that farmers in age group 1, 2, 3 and 4 had positive DTJ. Thus, as their age increases the benefit obtained from joining also increases. However, farmers in age group 5 showed a negative relationship with DTJ. The implication here is that at age group 5, as farmers' age increases, the benefit obtained from joining decreases. The implication here is that as age increases, the benefit obtained by joining and the likelihood of joining increases until age group 5 (51 to 61) where the benefit and the likelihood of becoming a member of an FBO begins to decrease.

These findings are quite consistent with those of McBride and Daberkow (2003), who found that increasing operator age decreases the likelihood of implementing precision farming technologies in the United States

of America. Ayamga (2006) also found that as age increases, the probability of a farmer to participate in microcredit programmes in Northern Ghana, decrease. According to him, the chances of older people being considered for credit are low, and are due to the low probability of success, coupled with the high risk of default. Again, their experiences sometimes make them feel complacent and thus impinge on their decision to participate in microcredit programmes. Gockowski and Ndoumbe (2004) in their study of the decision to implement intensive mono-crop horticulture in Southern Cameroon, also found that the age of the household head had a significant negative and elastic effect on adoption decisions Gamba et al. (2002) also confirmed these findings when they studied wheat farmers' seed management and varietal adoption in Kenya. Farmers' past negative experiences with an FBO or complacent of whatever knowledge they would obtain from becoming members of the FBO could account for this finding. It is therefore important for policies that seek to foster farmer group formation to be targeted at young farmers who are at least below the age of 51 years because, such farmers are very active and are highly interested in group formation than those beyond 51 years.

Farm size of the respondents had the expected positive

Table 5. Marginal effects and average elasticities.

Variable	Coefficient	Marginal effects	Average elasticity
AGE	1.853098**	0.7363866	63.080717
AGE_AGE	-0.015499*	-0.0061592	-23.628770
OCCU	2.090717 ^{ns}	0.655883	0.885442
FARMSIZE	1.017844**	0.4044725	5.996305
HHSIZE	-0.477582 ^{ns}	-0.1897823	-2.237059
SEX	1.390141 ^{ns}	0.5063294	0.569621
LOAN	10.22539***	0.9918893	1.500233
MACHINERY	4.397573*	0.967034	1.039562
INCOME	0.000676**	0.0002686	1.644896
CONSTANT	22.68067 ^{ns}	1.897634	7.5196264

*, ** and ***: Significant at 10, 5 and 1% respectively; ns: not significant.

sign, was significant and elastic (Table 5). Increasing a farmer's farm size by one acre increases the likelihood of joining an FBO by 40.4%. Most researchers have found a positive relationship between farm size and decision to join FBOs (Adimado, 2001; and Kheralla et al., 2001). The implication here is that farmers with larger farm sizes will tend to require more support in terms of marketing, pricing, and inputs, than their counterparts with smaller farm sizes hence, will want to join FBO or other associations which provide social capital.

Access to loans/credit had the expected positive sign and was highly significant. Access to credit relaxes the financial constraint and this helps farmers to diversify their portfolio. Thus, in the absence of non-farm income, farmers with access to credit can equally engage in farming activities that require financial expenditure. Getting access to credit increases a farmer's likelihood of joining an FBO by 99.1% (Table 5). This compares well with Nzomoi et al. (2007) who found a positive relationship between access to credit and the decision to adopt a given technology in horticultural export produce in Kenya and also with Mussei et al. (2001), who found out that access to credit had a positive influence on small-scale farmers' decision to adopt improved wheat technologies in Tanzania. The implication is that farmers are financially empowered if they have access to credit or loan and they are able to improve their productivity levels as well as their income via access to credit through the FBO which tends to increase the likelihood of becoming a member of an FBO. This is very important because it implies that when formulating policies that promotes group formation to ensure a cost effective extension delivery, The Ministry of Food and Agriculture and other relevant stakeholder should incorporate credit facilities as part of the package. This will increase small scale farmers' access to certain production inputs which they were not able to afford, which will in turn, result in increased production, yield, and incomes of resource poor farmers in Ghana.

Access to machinery services was also found to have a

significantly positive inelastic effect on farmers' decision to join. Increasing the farmers' access to machinery services increases the likelihood of joining farmer based organizations by 96.7. Farmers are more likely to join an FBO when they have access to machinery services for their farming activities. This is because most of the small scale farmers in the municipality cannot afford the cost of farm machinery and other implements such as tractors, ploughs and harrows. Lack of access to farm machinery and its timely supply has a major influence on the yields of farmers and their ability to increase production. Dealers in this equipment will however be more comfortable selling it to organizations (farmer based organizations) than individuals. In order to raise the incomes of small scale farmers and since they cannot individually afford to out rightly purchase this equipment, it is therefore imperative for policy makers, NGOs and other stakeholders to encourage group formation among farmers in order to enable them access this farm equipment.

Farmers' income had the expected positive sign and was highly significant. Increasing farmers' income by one Ghana cedi increases the likelihood of joining FBOs by 0.026%. This means that farmers with higher incomes are more likely to join farmer based organizations than their counterpart with lower incomes. Joining FBOs comes with some financial commitments in the form of payment of dues, making of some contributions, etc. Fulfilling these commitments is sometimes difficult for some small scale farmers because they cannot afford it. As a result, only those with higher incomes and can afford, tend to join the FBOs.

Conclusions

Undoubtedly, FBOs can fulfill several roles, contribute to various functions that enhance successful innovation and increasingly provide services themselves. FBOs are also increasingly valued for representing social capital that is

crucial for the necessary transformation of the African agricultural sector. The results of this study indicate that there are a number of factors influencing the decision of farmers to join farmer based organizations. The key factors include age, farm size, access to credit/loans, access to machinery services and income. Farmers will join FBOs when they have access to credit/loans through the FBO. By having access to credit, farmers are able to increase their production and output, as well as their income; hence becoming better off than not joining any FBO.

Farmers will also join farmer based organizations if they have access to machinery services such as tractor with ploughs, harrows and ridgers, since the cost of this equipment is so expensive that a small scale farmer cannot afford it all alone. To the small scale farmer, timely access to these machinery services will enable them to plant at the right time to coincide with the onset of rains so that their efforts made on the farm will produce good yields, better returns and increased incomes. Hence, policy makers should place more emphases on access to credit/loans and access to machinery services when designing programmes geared towards getting more farmers to join farmer based organizations and creating multi-actor platforms to transform the agricultural sector in Ghana. This will enhance a more rapid and cost effective extension delivery, increase incomes of small scale farmers and reduce poverty.

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