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The Potential of Farmer Field School in Cocoa Extension Delivery: A Ghanaian Case Study

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Abstract

The potential of Farmer Field School (FFS) as an extension approach in Africa is still evolving, with limited empirical evidence. Cocoa FFSs have been introduced in Ghana by the Ministry of Food and Agriculture and Ghana Cocoa Board (COCOBOD) since 2006, and are still being experimented with by COCOBOD and NGOs. But, little is known about its effects on farmers to inform COCOBOD's quest to mainstream and support it. This study, therefore, ascertains the potential of the FFS in terms of its effectiveness and impact on livelihoods of cocoa farmers in Ghana. Using a retrospective comparison design, a survey was conducted on beneficiaries of cocoa FFS in the Mpohor Wassa East District of the Western Region of Ghana. The case study found that the FFS was effective in facilitating farmers' acquisition of knowledge in all cocoa technologies practiced under the FFS. The participant farmers perceived their yields to have increased significantly up to 79%, and their household livelihoods improved due to the FFS. It was also perceived to have improved all capital assets of the farmers, with human capital being the most affected. The best predictors of impact on the livelihoods of the cocoa farmers in FFS were mirid control practices (40.7%), followed by training and extension methods (7.4%). It can be concluded from this case study that FFS can be an effective tool for cocoa extension in Ghana based on the confidence the study farmers have shown regarding its ability to improve farmer competence, yields, and household livelihoods.

Key Words: Extension, Cocoa, Farmer Field School, Impact, Livelihoods, Ghana

Introduction

In developing countries, the main source of the people's livelihoods is the agricultural sector. Livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living (Chambers & Conway, 1991). In Ghana, cocoa is a major economic crop contributing about 40% of agricultural exports, 12% of gross domestic product and provides livelihood to over 800,000 farmers and their dependants (Frempong, Asase, & Yelibora, 2007). The crop is reported to contribute about 70 – 100% of annual household income to farm families and some 60% to the national agricultural labor force (Ntiamoah & Afrane, 2008). Interestingly, the productivity of the cocoa sector is low compared to competitors such as Cote d'Ivoire, Indonesia, and Malaysia. The low productivity has been attributed to a myriad of constraints including low producer prices, poor agricultural extension support, low technology adoption, poor farm maintenance, declining soil fertility, mirid (capsid) attack, black pod disease infection, and bad weather (Adomako, 2007). According to Adeyemi (2000) the crop is performing far below its high yield potential. Being mindful of the situation, the government of Ghana has adopted several approaches and interventions to sustain the cocoa sector over the years. A notable among these interventions is the collaboration of COCOBOD and Ministry of Food and Agriculture with Sustainable Tree Crops Program (STCP) to promote Farmer Field School (FFS) as an extension approach in cocoa extension delivery to improve the capacity of cocoa farmers for higher and sustainable cocoa production in Ghana.

Having been implemented for the first time by the Food and Agriculture Organization of the United Nations in 1989, to control a widespread rice pest out-breaks in Indonesia, the concept of FFS gained some credence in the 1990s (Pontius, 2002). The concept is described as a participatory training approach, group extension method, and a form of adult education whereby farmers of similar interest (25- 30 in number) who meet regularly during the course of a growing season to experiment as a group with new production management options are given opportunity to make choices in the methods of production through discovery based approach (Adisa & Adeloye, 2002).

Since the Indonesia experience in 1989, the FFS has become one of the agricultural extension approaches for facilitating knowledge acquisition and skills development by farmers to solve their farming problems. As an experiential and a group-based approach, the FFS uses participatory methods coupled with hands-on experience sharing to help farmers acquire knowledge and skills. These knowledge and skills enable farmers to grow healthy crops, conserve natural enemies, and conduct regular field observations to improve farm productivity in a sustainable manner. The FFS approach was adopted in Ghana in 1995, but its major experimentation in the cocoa sector by the Ministry of Food and Agriculture in partnership with the Sustainable Tree Crops Program started in the Western Region in 2006. Since 2006, cocoa farmers in the Mpohor Wassa East District of the Western Region of Ghana had been trained through the FFS extension approach to build their capacities to improve cocoa production. Although anecdotal evidences indicate that the FFS is beneficial to cocoa farmers, there is limited empirical evidence on the effectiveness of the approach, its components (cultural practices, mirid control practices, black pod disease control practices, cocoa quality maintenance practices and the extension methods), and the impact on livelihoods of beneficiaries. As argued by Davis et al. (2010), much is still unknown about the FFS as an extension approach and its relationship with poverty reduction

(livelihood improvement), sustainability, participation, and financing in Africa.

Research Objectives

Given the background provided, this research was designed to determine the potential of the FFS with respect to its effectiveness and impact on livelihoods of cocoa farmers based on a Ghanaian case study of cocoa FFS in the Mpohor Wassa East District in the Western Region of Ghana. The specific objectives were to:

1. Assess the level of effectiveness of the key components of the cocoa FFS training
2. Determine the effect of FFS on the yields of cocoa farmers
3. Examine the levels of impact of FFS on cocoa farmers' livelihoods
4. Ascertain the extent to which the key components of the cocoa FFS can contribute to enhance farmers' livelihood.

Theoretical Framework and Context of the Research

From the Bennett's hierarchy for program evaluation (Bennett, 1979), a suitable extension program evaluation framework should provide information on levels of practice of improved technologies, yields and the livelihoods of beneficiaries. The Bennett impact evaluation framework was considered appropriate for the research given that the research sought to assess the perceived effectiveness and impact of the FFS on livelihoods of cocoa farmers. The FFS as an extension approach requires (a) inputs, (b) activities, (c) people's involvements, (d) reactions and (e) some behavioural change, which fit well with Bennett's hierarchy for program evaluation. Inputs in terms of time and staff are required for the implementation of the FFS. In this case study, cocoa community representatives were trained as facilitators, while Sustainable Tree Crops Program Master Trainers and Cocoa Research staff served as resource persons. The farmers were trained using various training materials for a period of ten months. Over the period, several activities were performed by the FFS participants. These included data collection from test cocoa trees, data analysis and presentation of findings by the participants in small groups. Farm visits and field days were also organised for the FFS stakeholders and facilitators to receive feedback on the cocoa production technologies propagated through the FFS. Theoretically, the FFS is expected to involve people (i.e. participants), but without compulsion, with the understanding that people have different interests, likes and dislikes. The issue of participation in farmer field schools has not been discussed much in the literature as posited by Davis (2006). For this particular case study, cocoa farmers who participated in the FFS programs did that on their own volition – an indication of their interest in the program.

The FFS participants were trained in key cocoa FFS Components. These were: (a) cultural practices (timely weeding, removal of mistletoes, shade tree management, and removal of chupons), (b) mirid control practices (mirid damage threshold level to decide spraying time, improved spraying practice for mirid control, pesticide screening, and mirid damage symptom identification), (c) black pod disease control practices (Sanitary harvesting, rational fungicide spraying, cocoa tree pruning, reduction of shade to reduce humidity), and (d) cocoa quality maintenance practices (timely harvesting of cocoa pod, timely breaking of pod, adequate fermentation of cocoa beans, and turning of fermentation heap).

Having gone through the FFS, it is expected that the farmers' capacity in cocoa production will improve and consequently, will affect the level of their livelihood assets (capitals). The indicators of the livelihood assets involve: (a) natural capital (household food, cocoa farm size, cocoa yield, quality of cocoa beans), (b) human capital (knowledge, self-skilled

labour, healthcare, ability to pay medical bill), (c) social capital (access to information, payment of : children's school fees, development levy, and funeral dues), (d) financial capital (income, savings, debt level, collateral insurance) and (e) physical capital (renovation of housing, building of housing, spraying machine, cutlass).

Methodology

A descriptive correlational survey design was used for the study in order to determine the type and degree of relationships that existed among the key variables of the study. Also, being an impact evaluation study, a retrospective (reflexive) comparison design was adopted to compare the FFS program participants to themselves, before (pre-test) and after (post-test) the intervention. Retrospective pre-test/post-test evaluations have been shown to be useful for documenting self-assessed changes that occur as a result of the particular intervention, as they tend to be more sensitive to participants' own feeling of change (Skeff, Bergen, & Stratos, 1992). Pratt, McGuigan, and Katzev (2000) described the design as better than the traditional pre-test/post-test methods if participants' perceived knowledge of a subject is based on incorrect information, a situation that may only be illuminated after they have participated in the program.

A total of 215 cocoa FFS participants, who were trained in 2006 in seven cocoa communities in the Mpohor Wassa East District in the Western Region of Ghana, formed the study population. From the population, 140 farmers were sampled using the lottery method, and based on Sarantakos' (1998) sample size determination table. Multiple sources of data collection were used. Oral administration of questionnaire through face-to-face interviews was the primary source of data. Documents from the FFS project, and observations made also provided useful information first, in the preparation the questionnaire and, the validation of responses provided by the research participants as means of triangulation. From the project documents (reports) the key objectives and components of the cocoa FFS training were defined. The face-to-face interviews offer the opportunity for some physical observations to validate a number of questions on the physical assets of respondents. A reliability test on the Likert-type scale questions in the questionnaire gave Cronbach's alpha reliability coefficients of 0.71 – 0.89, which from the literature (Pallant, 2001), is good for internal consistency.

Taking cognizance of the fact that impact of a training program may be affected by many other factors (Imbens & Wooldridge 2008), the purpose of the study was carefully explained to the study participants, and they were asked to reflect and give their candid opinion on how the intervention had affected their livelihoods. The main data were collected between March, 2011 and November 2012, and analyzed with the help of the Predictive Analytics Software version 15. Relevant statistics used included frequencies, percentages, means, standard deviations, *t*-test, *F*-test, and Pearson product-moment correlation coefficient.

Findings

The participants studied were male dominated (76%), which supports the belief that the cocoa sector in Ghana demands strenuous work, and thus, is more suitable for men who by nature are physically stronger than women. Their mean age was 50 years, with most (79%) of them between 41 to 80 years – a sign of aging farming population. The majority (78%) of them had had some level of education, with most (67%) up to Junior High or Middle School level. They had an average farming experience of 18 years with most (64%) of them with experience ranging between 11 to 50 years, and farm holdings ranging from 0.4 to 4 hectares.

Perceived effectiveness of the components of the cocoa FFS

FFS was effective in facilitating farmers' acquisition of knowledge in cocoa technologies, especially when famers perceived the knowledge as responsive to local concerns or needs. A key part of the cocoa FFS was that the farmers were trained in four need-based areas of cocoa husbandry namely, general cultural practices, black pod disease control, cocoa quality maintenance, and mirid control practices. Assessment of the training content and methods shows the farmers perceived all aspects of the cocoa FFS as 'effective' (*M* of *M* = 4.25) in improving cocoa production, with the cultural practice component as the most effective (*M* = 4.38; see Table 1).

Table 1

One–Way ANOVA of levels of Perceived Effectiveness of the Cocoa FFS Components

Key FFS Components	*M*	*SD*	*F*-ratio	Sig.
Cultural practices	4.38	0.54	7.06	0.00*
Black pod disease control practices	4.34	0.58		
Cocoa quality maintenance practices	4.28	0.57		
Training and extension methods	4.16	0.45		
Mirid control practices	4.08	0.62		
Mean of means (*M* of *M*)	4.25	0.56		

Note. Scale: 1 = *Very Ineffective*, 2 = *Ineffective*, 3 = *Moderately Effective*, 4 = *Effective*, 5= *Very Effective*; *$p < 0.05$; N =140. Sources: Survey data, March 2011.

Mirid control, comparably, was the least effective practice among the training components of the cocoa FFS. This is consistent with the Kenyan studies where the FFS was found to have assisted farmers to acquire more knowledge and to adopt more improved agricultural technologies (Bunyatta, Mureithi, Onyango, & Ngesa, 2005).

Effect of FFS on cocoa yields

As expected, the facilitation and adoption of improved techniques in cocoa production through FFS improve yields of cocoa for farmers. The results revealed that, before the FFS (i.e. 2005), about 79% of the cocoa FFS participants harvested less than 320 kg/ha of cocoa, while nearly 21% of the FFS participants had yields ranging from 320kg/ha to 960 kg/ha (see Table 2). On the average, about 209 kg/ha of cocoa was recorded with the range being about 27kg/ha to 800 kg/ha. After the cocoa FFS in 2009, the majority (66%) of the FFS participants had cocoa yields varying from 320kg/ha to 960 kg/ha, with the mean yield of about 375 kg/ha. The difference in mean yields before and after the FFS was significant and attributable to the FFS (see Table 2).

Table 2

Yield of Cocoa FFS Participants Before and After the FFS

	Before FFS (2005)		After FFS (2009)		
Yield (kg / ha)	*f* (%)	*M*(kg / ha)	*f* (%)	*M*(kg / ha)	Sig
Less than 320	96 (79.3)	209.2	42 (34.7)	375.2	0.000*
320 – 640	24 (19.9)		70 (57.9)		
641 – 960	1 (0.8)		9 (7.4)		
Total	121(100)		121(100)		

Note. M Difference = 165.96 kg/ha; t-ratio =13.82; *$p < 0.05$(2-tailed); Source: Survey data, March 2011.

The results show an average increase of 166 kg/ha, representing about 79 % increase in yield over the 2005 yield of 209.2kg/ha. Fafo (2006) reported an average yield of cocoa in Ghana as 300 kg/ha as against 1,000 kg/ha produced in Malaysia. As such, the finding suggests that with a good cocoa FFS program, cocoa famers in Ghana can have comparable yields (960 kg/ha) to their counterparts in Malaysia. This is consistent with the findings of Godtland, Sadoulet, de Janvry, Murgai, and Ortiz (2003) that FFSs have positive impact on knowledge and productivity of farmers.

Perceived impact of FFS on cocoa farmers' livelihoods

The findings indicate that besides the adoption of introduced techniques in cocoa production with resultant increases in yields, FFS can have positive social and economic impact on farmers, as have also been reported in some studies (Mwagi, Onyango, Mureithi, & Mungai, 2003). Mwagi et al. (2003) found much higher adoption of technologies and greater cohesiveness among FFS groups. Not surprising, farmers from the study perceived their livelihoods to have significantly improved (*M* = 2.21 to 3.90) after going through the FFS (see Table 3). Livelihood here refers to the means by which the farmers obtain and maintain access to essential resources to ensure their immediate and long-term needs. In this case, the livelihood resources included the farmers' natural, human, social, financial and physical capitals. This suggests FFS can improve assets of famers. Reddy and Suryamani (2005) and Godtland et al. (2003) have both reported FFS improves human capital by improving farmers' knowledge. Similarly, van den Berg (2004) and Simpson and Owen (2002) found FFS to have improved famers' financial capital through the reduction of their cost of production and increase in their profit. Notwithstanding, the work of Feder, Murgai, and Quizon (2004) in Indonesia found no significant impact of FFS on economic performance, environmental and health situations of famers. For in-depth understanding, the impact of the FFS on the components of the farmers' livelihood assets – natural, human, social, financial and physical capitals, have been discussed in the following sections.

Table 3

Dependent (paired) Sample t-test of Perceived Levels of Livelihoods of Cocoa FFS Participants Before and After the FFS

Perceived Impact on Livelihoods	*N*	*M*	*SD*	*M* Diff.	*t*-test	Sig.
Before FFS	140	2.21	0.65			
After FFS	140	3.90	0.67	1.68	26.18	0.000*

Note. Scale: 1 = *Very Low*, 2 = *Low*, 3 = *Moderate*, 4 = *High*, 5 = *Very High*; *$p < 0.05$; Source: Survey data, March 2011.

Impact on livelihood assets of cocoa farmers

The study shows cocoa FFS can have positive impact on cocoa farmers' natural capital – the natural assets (e.g. farmland and its productivity) available to them for sustainable economic activity and livelihood security. The famers perceived their natural assets to have improved from low to high (*M* = 2.37 to 3.93) after the FFS program (see Table 4). Improvement in the quality of cocoa beans was perceived to be 'high' (*M* = 4.16), and the best rated among the natural capital assets after the FFS. Although the farm size was perceived to have been highly increased (*M* = 3.75) as a result of the FFS, it was the least affected by the FFS program compared with other natural assets including cocoa yield and household food increase.

The research shows that FFS can increase human capital of cocoa farmers. The results show an increase in human capital from low (*M* = 2.22) before the FFS, to high (*M* = 4.13) after the FFS. As expected from a successful training, increase in knowledge and access to self-skilled labour were perceived as the most improved of the human capital assets (*M* = 4.29). Ability to pay additional medical bills' was perceived to have received the least improvement though it was also perceived to have highly increased (*M* = 3.94).

Similar to the other findings, FFS provides some social capital gains for farmers. From the study, the FFS participants perceived their social capital to have improved from low (*M* = 2.32) to high (*M* = 3.93) after the FFS program. More specifically, payment of children's school fees, development levy, funeral dues, and access to information were all perceived by the famers to have highly improved due to the FFS program. Payment of funeral dues was however, the most improved (*M* = 4.00) among the social capital livelihood assets.

The study also shows FFS can improve financial capital livelihood assets of cocoa farmers. From the study, the farmers who participated in the FFS perceived their financial capital to have improved from low (*M* = 2.12) to high (*M* = 3.79) after the FFS in 2009. Aspects of the financial capital, including increase in income from cocoa, increase in savings, decrease in debt level, and increase in collateral insurance were all perceived to have highly improved after the FFS. These findings were expected on the basis that the FFS improved cocoa yields as a result of improved knowledge of farmers and their use of introduced techniques.

Table 4

Mean Impact of Cocoa FFS on Livelihood Assets Before and After the FFS

Livelihood Assets	Before FFS		After FFS	
	M	*SD*	*M*	*SD*
Natural Capital				
Improved quality of cocoa beans	2.39	0.86	4.16	0.82
Increase in cocoa yield per unit area	2.17	0.76	3.99	0.78
Increase in the quantity of household food	2.44	0.94	3.81	0.80
Increase in cocoa farm size	2.49	0.81	3.75	0.83
Sub Mean	*2.37*	*0.84*	*3.93*	*0.81*
Human Capital				
Increase in knowledge	2.14	0.81	4.29	0.73
Access to self-skilled labour	2.11	0.81	4.29	0.73
Ability to register household on National Health Insurance Scheme	2.29	0.94	3.99	0.93
Ability to pay additional medical bills	2.33	0.98	3.94	0.85
Sub Mean	*2.22*	*0.89*	*4.13*	*0.81*
Social Capital				
Payment of funeral dues	2.50	1.00	4.00	0.87
Payment of development levy	2.44	0.95	3.97	0.86
Payment of children's school fees	2.32	0.99	3.94	0.90
Access to information	2.01	0.91	3.79	0.85
Sub Mean	*2.32*	*0.96*	*3.93*	*0.87*
Financial Capital				
Increase in cocoa farm income	2.13	0.78	3.91	0.80
Increase in collateral insurance	2.09	0.92	3.81	0.86
Decrease in debt level	2.20	0.88	.79	0.83
Increase in savings	2.06	0.94	3.65	0.86
Sub Mean	*2.12*	*0.88*	*3.79*	*0.84*
Physical Capital				
Acquisition of simple farm tools (e.g. cutlass)	2.33	0.99	4.07	0.92
Acquisition of spraying machines	1.86	0.84	3.70	0.97
Renovation of housing	2.07	0.94	3.69	0.92
Building of new housing	1.91	0.97	3.64	1.17
Sub Mean	*2.04*	*0.94*	*3.78*	*0.99*
Overall Mean	**2.21**	**0.65**	**3.90**	**0.67**

Note. Scale: 1 = *Very Low*, 2 = *Low*, 3 = *Moderate*, 4 = *High*, 5 = *Very High*; *n* =140. Source: Survey data, March 2011.

The study shows FFS can have significant impact on the physical capital of cocoa farmers. Generally, the FFS participants perceived their physical capital to have improved from low (*M* = 2.04) to high (*M* = 3.78) after the FFS. Renovation of housing, acquisition of cutlass, building of new housing, and acquisition of spraying machine were all improved after the FFS. The farmers indicated they could purchase and own the necessary simple farm tools such as cutlasses (*M* = 4.07), spraying machines (*M* = 4.07) and renovate or build new houses after the FFS. This ascription is expected based on the finding that FFS can

improve cocoa yields (see Table 2) and consequently farm income.

Contribution of the key components of the FFS to cocoa farmers' livelihood

The Pearson product-moment correlation coefficient (*r*) indicates a relationship exists between perceived impact of the cocoa FFS and the perceived effectiveness of the five key FFS components (cultural practices, mirid control practices, black pod disease control practices, cocoa quality maintenance practices and, training and extension methods) as presented in Table 5.

Table 5

Pearson Correlation Matrix of Perceived Impact on Livelihood and the Effectiveness of the Five Key Components of the Cocoa FFS

Variables	Y	X_1	X_2	X_3	X_4	X_5
Y	-					
X_1	0.516*	-				
X_2	0.641*	0.573*	-			
X_3	0.571*	0.757*	0.698*	-		
X_4	0.519*	0.615*	0.562*	0.752*	-	
X_5	0.525*	0.518*	0.427*	0.558*	0.511*	-

Note. *$p < 0.05$ (2- tailed); $n = 140$. Y = Perceived Impact on Livelihoods, X_1= Cultural Practices, X_2 = Mirid Control Practices, X_3 = Black Pod Disease Control Practices, X_4 = Cocoa Quality Maintenance Practices, X_5 = Training and Extension Methods. Source: Survey data, March 2011.

Interpretation of the results using Davis' (1971) conversion implies there is a positive and substantial significant relationship between impact on livelihoods and effectiveness of each of the five key components of the cocoa FFS: cultural practice component ($r = 0.516$); mirid control practice component ($r = 0.641$); black pod disease control practice component ($r = 0.571$); cocoa quality maintenance practice component ($r = 0.519$); and lastly, training and extension methods component ($r = 0.525$).

The relationships identified suggest each of the five key cocoa technology components was essential in improving the livelihoods of the FFS participants. David (2008) noted black pod disease causes about 50 % or more of cocoa pod losses. It is therefore not surprising that the effectiveness of black pod disease control practices was perceived by the FFS participants to have contributed significantly to their livelihoods. The positive relationship between impact on livelihoods and effectiveness of cocoa quality maintenance can be attributed to the fact that farmers will not have their cocoa beans rejected as a result of poor quality by the licensed buying companies. It was also observed that the impact of FFS training on farmers' human capital such as knowledge and skills enables them to make cost-effective (financial capital) and environmentally (natural capital) friendly decisions (Reddy & Suryamani, 2005). Therefore, the significant contribution of the training and extension methods to livelihoods as perceived by the cocoa FFS participants cannot be overemphasized.

A stepwise multiple regression of the perceived impact of the effectiveness of the key cocoa FFS components on livelihoods is shown in Table 6. The results show two out of the five

independent variables used in the model significantly explained the participants' perceived impact of the cocoa FFS on their livelihoods. The two best predictor variables were FFS participants' perceived effectiveness of (a) mirid control practice component and (b) training and extension methods component of the FFS program.

Table 6

Stepwise Multiple Regression of Perceived Impact of the Key Components of Cocoa FFS on Participants' Livelihoods

Predictor(s)	Step of Entry	Beta (standar-dised)	R^2	Adj. R^2	Adj. R^2 Chan ge	S.E.E	*F* Reg.	*F*.Sig
X_2	1	.51	.41	.41	.41	.52	96.29	.00*
X_5	2	.31	.49	.48	.07	.49	65.33	.00*

Note. *$p < 0.05$ (2- tailed); $n = 140$. Source: Survey data, March 2011

The regression analysis provide variables which were statistically significant at 0.05 alpha level, so the following equation was formulated to estimate the cocoa FFS participants' perceived impact of the cocoa FFS on their livelihoods.

$$Y = a + \beta X_2 + \beta X_5,$$
$$Y = - 0.279 + 0.557X_2 + 0.457X_5$$
$$Y = - 0.279 \quad \text{if} \quad \beta_2 = \beta_5 = 0$$

Where: Dependent variable (Y) = Perceived Impact on Livelihoods

a = constant; β = unstandardized Beta

X_2 = Mirid Control Practices

X_5 = Training/Extension Methods

The results show the two components together explained 48% of the variance in the perceived impact of the cocoa FFS on participants' livelihoods (Adjusted $R^2 = 0.48$, see Table 6). Whilst the first component (mirid control practices) made 41% contribution (Adjusted R^2 change = 0.41), the second component (training/extension methods) contributed 7 % (Adjusted R^2 change = 0.07) towards the explanation of the cocoa FFS participants' perceived impact of the cocoa FFS on their livelihoods. The values of the Standard Error of Estimate (S.E.E) allow us to determine the limits of the confidence that we can exhibit in the prediction from the regression equation Bryman & Cramer, 2008). For instance, for "mirid control practice component," it can be 95% certain that the population regression coefficient (0.56) was between $0.56 + (1.96 \times 0.52)$ and $0.56 – (1.96 \times .52)$. The implications of these results are that any unit increase in the quantity of any of the independent variables (mirid control practices, training and extension methods) will increase impact by the value of their estimated coefficients. This means that improvement in mirid control practices, training and extension methods in FFS can uniquely have significant and positive impact on cocoa farmers' livelihoods in Ghana.

Mirid control (the best predictor) has been one of the major concerns of the Ghana Government and COCOBOD for many years. Thus, in 2001 the government launched a Cocoa Diseases and Pest Control Program (CODAPEC) popularly known as "Mass Spraying" to assist all cocoa farmers in the country to combat mirid and the black pod disease. According to David (2008), mirid infestation causes about 30% or more of bean losses if not controlled. It is therefore unsurprising that the mirid control practice component was perceived to have

contributed significantly (41%) to improve FFS participants' livelihoods.

The second variable in the step of entry was ''perceived effectiveness of training and extension methods component.'' This component accounted for 7% in the prediction, and has been the pivot of the cocoa FFS program. This is because after using Training and Visit (T&V) approach in cocoa extension for some years in Ghana, it was found to be inadequate to change farmers' practices as it pays little attention to farmer knowledge and experience sharing (David et al., 2005). Cocoa extension was therefore turned over to Ministry of Food and Agriculture (MOFA) in 2000 with the aim of providing a more cost effective extension services to farmers (Amezah & Hesse, 2002). Since the inception of the cocoa FFS program, stakeholders have been eager to know the level of contribution of the cocoa FFS to livelihoods.

Conclusions and Implications

Based on the findings of the study, the following conclusions were drawn. Technology transfer through FFS has the potential of improving small-holder cocoa farmers' knowledge, adoption and yields. FFS training programs can lead to improvement of livelihood assets of small-holder cocoa farmers in Ghana, if the farmers perceive key training components of the FFS to be effective. The study suggests a positive and substantial significant relationship can exist between perceived effectiveness of the key components of the cocoa FFS and its perceived impact on farmers' livelihoods. The level of effectiveness of mirid control practices and training and extension methods can predict the impact in FFS training program on small-holder farmers' livelihoods. A key implication of the findings is that positive outcomes can be realized from FFS as an extension delivery approach with small-holder cocoa producers, if responsible institutions including the COCOBOD and NGOs pay special attention to mirid control, training and extension methods used in cocoa FFS programs.

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