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PERCEIVED IMPACT OF COCOA INNOVATIONS ON THE LIVELIHOODS OF COCOA FARMERS IN GHANA: THE SUSTAINABLE LIVELIHOOD FRAMEWORK (SL) APPROACH

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ABSTRACT

The Cocoa High Technology Programme (CHTP) was introduced by the Government of Ghana in 2003 with the aim of improving the fertility of the soil thereby increasing the yields and incomes of cocoa farmers. A correlational survey design was used in the Eastern Region of Ghana to examine the perceived impact of the CHTP on the livelihoods of cocoa farmers who adopted the technology using the Sustainable Livelihood Framework (SL) Approach. The level of impact of the programme on farmers' livelihoods as a 'whole' though higher, was below the expectations of cocoa farmers. The study further revealed that farmers' yields were significantly improved by the CHTP with mean increase of 72% (from 2.85 bags/acre to 4.9 bags/acre), three years after the implementation of the CHTP. The results of stepwise multiple regression analysis revealed that (1) fertilizer application; (2) harvesting, fermentation and drying technologies; and (3) fungicide application were the best predictors of impact on livelihoods of cocoa farmers.

Key words: Cocoa Innovations, Sustainable Livelihoods Framework, Cocoa High Technology Programme, Ghana, Perceived Impact

INTRODUCTION

Cocoa (*Theobroma cacao,* L.) is the dominant tree crop in Ghana, accounting for 20.5% of Ghana's export earnings, 3.3% of GDP and the sub-sector employs 24% of labour force (FASDEP, 2002). It also accounts for 55% of the total household income among cocoa farmers in Ghana (IITA, 2002). Therefore, a significant growth of the economy depends, to some extent, on the growth of the cocoa sector.

West Africa produces 70 percent of the world's cocoa, with Côte d'Ivoire and Ghana supplying 40 and 25 percent of global consumption respectively (Dizolele, 2005). The average national annual yield in Ghana, around 350 kilograms per hectare (kg/ha), is very low compared to 800 kg/ha in Côte d'Ivoire, or 1700 kg/ha in Malaysia (Appiah, 2004).

The relatively low yield of cocoa in Ghana has been attributed to a number of reasons including high incidence of pest and diseases (such as capsids, swollen shoot virus disease (CSSVD), and black pod disease), decline in soil fertility and

inconsistency in rainfall pattern. Also, a greater number of farmers are still using primitive technologies in this era where biotechnology and other scientific innovations give farmers a basket of options to choose from.

The British Government, in1938, established the West Africa Cocoa Research Institute (WACRI) now the Cocoa Research Institute of Ghana (CRIG) with the mandate to research into problems affecting production and utilization of cocoa in West Africa. Some of the achievements of CRIG are the control of capsids, characterization of cocoa swollen shoot disease as caused by a virus, discovery of mealy bugs as vectors of the virus and the control of the disease by eradication, and development of early bearing and high yielding hybrids (Appiah, 2004). Current efforts to boost cocoa production include the Cocoa Disease and Pests Control Programme (CODAPEC), popularly known as mass spraying, control of the Swollen Shoot Virus Disease (CSSVD), and the Cocoa High Technology Programme (CHTP).

Attempts to assess the impact of the programme have concentrated mostly on yields and income of farmers. For example, Appiah (2004), reported that there has been an increase in cocoa yields since the adoption of the programme and in 2002/03 season, a production figure of 497,000 metric tonnes was achieved- the second highest production ever achieved in Ghana. However, farmers' perceptions on the impact of the programme on various facets of their livelihoods have not been examined in various cocoa regions that adopted the programme and the Eastern Region was no exception. Moreover, the perceived effectiveness of the various components of the CHTP as well as the programme as a whole has not been assessed by beneficiary farmers. Rogers has opined that people's (farmers') perceptions about a programme are very important in adoption and sustainability of a programme or an innovation in a social system.

The Cocoa High Technology Programme (CHTP)

The 'Cocoa High Technology' of cocoa production is defined as "the sustainable cocoa production by which the farmer increases and maintains productivity, through soil fertility maintenance at levels that are economically viable, ecologically sound and culturally acceptable using efficient management of resources" (COCOBOD, 2002, p. iv). The programme emphasizes the use of fertilizer and proper farm management practices to achieve higher cocoa yields. The holistic approach of the CHTP involves five (5) main components namely, 1. *Cultural maintenance of farm*, *2. Application of fertilizer*, 3. *Spraying of fungicide, 4. Spraying of insecticide, 5. Harvesting, fermentation and drying technologies.* Under the programme, fertilizer, fungicides and insecticides are given to farmers on credit from the government (represented by CRIG) through Licensed Buying Companies (LBCs) that registered farmers. Beneficiary farmers pay part of the credit (about one-third) and the LBCs deduct the rest of the credit from the produce of farmers when they sell their produce to them at the end of the cocoa season. Farmers receive equal quantity of the package irrespective of the size of their farms provided they have a minimum of 2 acres of mature cocoa farm (CRIG, 2004).

The Sustainable Livelihood Framework (SL)

The study adapted the Sustainable Livelihood (SL) Framework which defines livelihoods as the assets, activities, and access that determine the living gained by individuals or households (Ellis, 1998 & 1999).The Sustainable Livelihoods (SL) framework helps to analysis the links between livelihoods and natural resource use (Scoones, 1998; Carney, 1998; Ellis,

1999). The central idea of the framework is that sustainability of livelihood strategies of individuals or households depends on access to, use, and development of different types of assets.

The purpose of this framework, according to Woodhouse et al. (2000 a & b), is to provide a simple, quick, and easily understood assessment of the status of access, endowment and or utilisation of the different capitals based on local understanding and perceptions of stakeholders in the system. The framework is based on the five capitals of the sustainable livelihoods and describes the low and high status in access, use and/or endowment of the five capitals as defined in locally understood terms and perceptions.

The five basic types of capital that comprise assets for livelihoods are natural, physical, financial, human, and social. For each capital, a different range of words, pictures, scenarios or indicators are determined by the relevant stakeholders to represent the best and worst scenarios in their view. The framework is then used to assist in the interpretation of local criteria of success, the identification of local indicators and to assess the success of the systems from the perspective of different stakeholders and also the information can be used to compare different systems and the status of different groups within the same system. The framework considers assets as stocks of different types of 'capital' that can be used directly or indirectly to generate livelihoods and these can give rise to a flow of output, possibly becoming depleted as a consequence, or may be accumulated as a surplus to be invested in future productive activities.

Natural capital consists of land, water, and biological resources such as trees, pasture, and wildlife. The productivity of these resources may be degraded or improved by human management. Physical capital is that created by economic production. It includes infrastructure, such as roads, irrigation works, electricity supply, and reticulated water, and also producer goods such as machinery. Human capital is constituted by the quantity and quality of labour available. At household level, therefore it is determined by household size, education, skills, and health of household members. Financial capital consists of stocks of money or other savings in liquid form. In this sense, it includes not only financial assets such as pension rights, but also includes easily-disposed assets such as livestock, which in other senses may be considered as natural capital. Social capital includes any assets such as rights or claims that are derived from membership of a group. This includes the ability to call on friends or kin for help in times of need, support from trade or professional associations (e.g. farmers' associations), and political claims on chiefs or politicians to provide assistance.

In summary, the Sustainable Livelihood Framework is an influential model for the conceptualization of rural people's livelihoods and has been adopted by many programmes and projects, particularly those under the Department For International Development (DFID), UK sphere of influence (Bond, Kapondamgaga, & Ragubendra , 2003). At the heart of this model is the concept of a 'livelihood platform', five capital assets which households access and utilize for their diverse livelihood strategies and which provide the sustainability to those livelihoods.

Objectives Of The Study

The main objective of the study was to examine the perceived impact of the Cocoa High Technology Programme (CHTP) on the livelihoods of farmers in the Eastern Region of Ghana. Specifically, the study sought to

i. find out perceptions of farmers on the effectiveness of the various components of the CHTP.

ii. impact of the CHTP on the livelihoods of beneficiary farmers.

iii. examine relationships between effectiveness of the components of the CHTP and impact on livelihoods of farmers.

iv. find out the best predictors of impacts on livelihoods from the components of the CHTP.

METHODOLOGY

This paper is a part of a scholarly research conducted on the impact of the CHTP on livelihood of farmers in Eastern Region of Ghana (Bosompem, 2006)**.** Correlational survey was used to examine cocoa farmers in the Eastern Region of Ghana, who have adopted the CHTP. Four (4) districts (Birim South, East Akim, Fanteakwah and Birim North) were randomly selected from the nine (9) main cocoa growing districts which undertook the CHTP in the Eastern Region of Ghana in 2003. Content - validated structured interview scheduled was used for the study developed to access the perceived effectiveness, perceived impact of the CHTP programme on their livelihoods and background characteristics of farmers. A five-point Likert-type scale was developed to measure perceived effectiveness (from very effective to very ineffective) and impact (Very High to Very Low) of CHTP. The instrument was pre-tested to help determine its reliability. The perceived effectiveness subscale (17 items) and perceived impact on livelihoods (20 items) had Cronbach's alpha co-efficients of 0.87 and 0.79 respectively indicating that the instrument was reliable (Pallant, 2001)

Stratified random sample was used to select 200 farmers who had adopted the CHTP for at least three (3) years since its inception in 2003 from the four (4) districts based on the number of farmers who adopted the programme in each district. Therefore, 68, 53, 38, 41 farmers were chosen from Birim South (N=2500), East Akim (N=1939), Fanteakwah (N=1399), Birim North Districts (N=7356) respectively totalling 200 farmers. Data was collected through personal interviews with the farmers. With the help of Statistical Product and Service Solutions (SPSS) version 12.0, measures of central tendencies and dispersions, frequencies and percentage distributions, dependent sample t-test, Pearson product-moment correlation co-efficients, and Ordinary Least Square (OLS) using stepwise multiple regressions step of entry were used.

RESULTS

Perceived Effectiveness of the Main Components of the CHTP

The results of the study revealed that about 83%, 99%, 74%, 89% and 88% of the respondents implemented respectively, the various components of the CHTP namely (1) cultural maintenance, (2) fertilizer application, (3) fungicide application (4) insecticides application, and (5) harvesting, fermentation and drying technologies Table 1 . There was an exception in one of the sub-components of the 'fertilizer application component' (Application of the fertilizer at the beginning of the raining seasons) where only approximately 42% of respondents implemented. Moreover, respondents perceived all the 5 main components to have been effective in contributing to their yields and income and other aspects of their livelihoods. .

Table 1: Mean perceived effectiveness of the main components of the CHTP

Main Components of the CHTP	%	$\overline{X}$	SD
Cultural Maintenance	83	3.79	0.71
Application of fertilizer	99	3.76	0.83
Application of fungicide	74	3.61	0.86
Application of insecticides	89	3.85	0.78
Harvesting, fermentation & drying of cocoa beans	88	4.04	0.66
Overall Mean Effectiveness	-	3.81	0.66

n=200. Mean ($\overline{X}$) scores were computed from the scale : 5=Very Effective 4=Effective; 3=Average ; 2=Ineffective; 1=Very Ineffective

Source: Field Survey Data, 2006

Yields Before and After the Implementation of the CHTP

The study further revealed that farmers' yields were significantly improved (at 0.05 alpha level) by the CHTP with mean increase of 72% (from 2.85 bags/acre to 4.9 bags/acre), three years (Average between 2003 and 2005) after the implementation of the CHTP (Table 2). However, the increase in yields though significant, were below the expected CHTP yield of 10 or more bags/acre primarily because only 42% were able to apply the fertilizer at appropriate times due to late arrival and distribution of the fertilizers to farmers (Appiah, 2004)

Table 2: Dependent Sample t-test of Yield of Beneficiaries Before and After the CHTP

Years	n	$\overline{X}$ yield (bags/ acre)	SD	t ratio	Sig.
2002	186	2.85	4.5	11.36	0.000*
2003	186	4.75	6.2		
2002	186	2.85	4.5	7.76	0.000*
2004	143	4.50	7.1		
2002	186	2.85	4.5	9.72	0.000*
2005	37	5.9	8.3		
2002	186	2.85	4.5	11.32	0.000*
*Average (2003 -2005)	186	4.9	5.7		

n=200. p< 0.05 **1bag=64 kg**
Source: Field Survey Data, 2006.

Impact of the CHTP on Five Categories of Capital (Livelihood) of Farmers

Table 3 presents the perceived impact of the CHTP on the five (5) various categories of respondent' livelihoods. Between 95%-99.5% of the respondents acknowledged improvement of their natural capital which included improvement in yield, productivity and high quality beans and they also perceived "High"($\bar{X}$ = 3.51, SD= 0.83) improvement of their natural capital as a result of the programme. With respect to impact on physical capital (which included ownership and access to production equipment such as sprayers, prunners and harvesters), about 85% of the respondents were able to acquire harvesters but few respondent farmers were able to acquire sprayers (29%) and prunners (29.5%) as a results of the CHTP. Respondents, also perceived "High"($\bar{X}$ = 3.50, SD= 0.84) impact of their physical capital.

Table 3. Mean Perceived Impact on various Livelihood Categories of Farmers

Livelihoods Category (Capital Assets)	n	$\overline{X}$	SD
Natural Capital	n (Yes)		
Increase in yield.	190 (95.0)	3.46	0.89
Increase in yield per unit area.	193 (96.5)	3.40	0.91
Increase in yield per unit cost of inputs.	198 (99.5)	3.38	0.88
Better quality of beans.	189 (94.5)	3.77	0.84
Weighted Mean ($\overline{X}$ w)		3.51	0.83
Physical Capital	**n (Yes)**	$\overline{X}$	**SD**
Ownership of Sprayer	54 (27.0)	3.56	1.19
Ownership of prunner	59 (29.5)	3.36	1.30
Ownership of Harvester	159 (79.5)	3.77	1.05
Access to vehicles	65 (32.5)	3.66	1.08
Access to Sprayers	172 (86.0)	3.31	0.93
Access to prunner	103 (51.5)	3.50	1.04
Access to Harvester	184 (92.0)	3.74	0.97
Weighted Mean ($\overline{X}$ w)		3.50	0.84
Financial Capital	**n (Yes)**	$\overline{X}$	**SD**
Increase in income levels	184 (92.0)	3.22	0.87
Increase in saving levels	82 (41.0)	3.16	1.20
Decrease in debt levels	177 (88.5)	3.44	1.16
Access to credit facility	38 (19.0)	3.16	1.33
Weighted Mean ($\overline{X}$ w)		3.27	0.88
Human Capital	**n (Yes)**	$\overline{X}$	**SD**
Access to skilled labour	161 (80.5)	3.06	0.97
Access to unskilled labour	184 (92.0)	3.22	0.95
Access to public extension services (e.g.AEAs)	136 (68.0)	3.44	0.97
Access to private extension services (e.g. NGOs)	4 (2.0)	3.25	0.96
Weighted Mean ($\overline{X}$ w)	-	3.27	0.88

Table 3: continued

Social Capital	n (Yes)	$\overline{X}$	SD
Membership to association or farmer group	29 (14.5)	3.41	0.98
Support from association/farmer group	29 (14.5)	3.31	1.04
Ability to feed family members	194 (97.0)	3.23	0.76
Support to other family members	142 (71.0)	2.77	0.89
Support to friends	101 (50.5)	2.65	0.95
Ability to pay school fees.	185 (92.5)	3.21	0.84
Other Social Obligations (e.g. funeral dues and basic rate)	188 (94.0)	3.04	0.63
Weighted Mean ($\overline{X}$ w)		3.02	0.62

n=200, Mean ($\overline{X}$) scores were computed from the scale: 5= Very High (VH), 4 =High (H), 3= Average (A), 2 = Low (L), 1= Very Low (VL) . The Number in the parenthesis ( ) are percentages.

Source: Field Survey Data, 2006

The most important sub-facet of financial capital that was examined was the 'increase in income' of respondents. The results again showed that about 92% claimed that the programme resulted in increase in their income and therefore about 88% were able to pay back their credits either in full or in part. Due to this only 41% were able to save part of their income. Few respondents (19%) were able to enhance their access to credit facility. However, they perceived "average" impact on ($\overline{X}$ = 3.27, SD= 0.88) financial Capital which implied that impact on their financial capital had improved but below their expectation. About 68 to 92 percent perceived that various sub-facets of their human capital (which included access to both skilled and unskilled labour as well as public extension) were improved due to the CHTP. Only 2% had access to private extension service as a result of the programme. Many sub-components of social capital (which included ability to feed family members, pay school fees, support friends) were improved as a results of the programme. About 51% to 97% claimed that they were able to meet these social obligations as a result of the programme. Few respondents (14.5%), however, claimed that they were able to join and benefit from farmers' associations/groups due to the programme, a vital ingredient of building social capital formation

The results from Table 4 pointed out that farmers generally perceived impact on physical ($\overline{X}$ = 3.51, SD=0.81), and natural ($\overline{X}$ = 3.51, SD=0.84), capital to be 'high'. They also perceived that impact on the other three (3) facets of livelihoods namely financial capital ($\overline{X}$ = 3.27, SD=0.88), human capital ($\overline{X}$ = 3.27, SD=0.88) and social capital ($\overline{X}$ = 3.02, SD=0.62) was 'Average'. The programme, therefore, improved the two immediate aspects of livelihood (natural and physical) more than the rest.

Table 4: Ranking the perceived impact of CHTP on the Main Categories of Respondent farmers' Livelihood

Livelihoods Category	n	$\overline{X}$	SD	Ranking
Natural Capital	199	3.51	0.83	1st
Physical Capital	196	3.50	0.84	2nd
Human Capital	197	3.27	0.88	3rd
Financial Capital	190	3.27	0.88	3rd
Social Capital	198	3.02	0.62	4th
Mean (Weighted, $\overline{X}$ w) Impact on livelihoods		3.32	0.62	

n=200, Scale: 5= Very High (VH), 4 =High (H), 3=Average (A), 2 = Low (L), 1= Very Low (VL).
Source: Field Survey Data, 2006

The least impacted facet of livelihood examined was the social capital. This showed that increases in yield do not automatically translate to improvement in other aspects of farmers' livelihood, especially social capital. Generally, respondents perceived that impact of the programme on their 'overall' livelihoods was 'Average' ($\overline{X}$ =3.32, SD=0.66) implying that the level of impact though high, was not as high as they anticipated.

Relationship between the Perceived Impacts of the CHTP on Livelihood and Farmers' Perceived Effectiveness of the CHTP

The Pearson product-moment correlation co-efficients presented in the Table 5 show that there were direct (positive) and substantial significant relationships between the farmers' perceived impact on livelihood and the effectiveness of each of the five (5) main components of the CHTP even under 0.01 alpha level **(**Davis, 1971).

Table 5: Pearson Correlation Matrix of Perceived Impact on Livelihood and the Effectiveness of the Five (5) Main Components of the CHTP

Variables	Y	X_1	X_2	X_3	X_4	X_5
Y	-					
X_1	**0.573****	-				
X_2	**0.667****	0.653**	-			
X_3	**0.666****	0.664**	0.779**	-		
X_4	**0.587****	0.718**	0.642**	0.703**	-	
X_5	**0.639****	0.794**	0.632**	0.645**	0.704**	-

Source: Field Survey Data, 2006 *p < 0.05 (2-tailed). **p< 0.01 (2-tailed)

Y = Perceived impact on livelihoods.

X_1 =Cultural maintenance

X_2 = Fertilizer Application

X_3 =Fungicide Application

X_4 =Insecticide Application

X_5 =Harvesting, fermentation and drying technologies

The implication of the relationships is that each of the five components was important in enhancing the livelihoods of cocoa farmers who adopted the CHTP. For example, the application of fertilizer increased the yields of farmers and when prices are favourable, the income of farmers would be increased thereby improving their livelihoods. Similarly, the other four (4) components are equally and significantly important in improving the livelihoods of farmers.

Table 6: Collinearity Diagnostic Test

Independent Variables	R-squared	t- values of the Beta	Sig.
Constant	-	3.277	0.001*
Fertilizer Application	0.488	3.698	0.000*
Harvesting, fermentation & drying	0.542	3.681	0.000*
Fungicide Application	0.563	2.885	0.004*

n=200 *p<0.05 Source: Field Survey Data, 2006

Multicollinearity test was done to ensure that significant relationships among the independent variables do not bias the regression prediction. From the correlation matrix in Table 5, and the R-squared and t-value significance in Table 6, showed that there was no significant collinearity (i.e. correlations among independent variables are less than 0.8, R-squared is less than 0.75 and all t-values of the beta are significant) that may bias the prediction, hence all the five (5) predictors were used for the prediction (Gupta, 2000)

Predictors of Perceived Impact of CHTP on Farmers' Livelihoods

Three (3) best predictor variables on livelihoods of respondents were perceived effectiveness of (1) fertilizer application; (2) fungicide application; and (3) harvesting, fermentation, and drying components of the CHTP **(Table 7)**

It was observed that these three (3) components together accounted for a total of 55.5% of all the variance in farmers' perceived impact of the CHTP on their livelihoods. Farmers' perceived effectiveness of fertilizer application was the overall best predictor, accounting for 48.6% of the variance in farmers' perceived impact of the programme on livelihoods. Farmers' perceived effectiveness of harvesting, fermentation and drying technologies and effectiveness of fungicide application contributed 5% and 1.9% respectively in explaining the variance in farmers' perceived impact on livelihoods.

Table 7: Stepwise Regression (OLS) of Main Components of CHTP on Impact on Livelihoods of Cocoa Farmers

Predictors	Step of Entry	Beta (standardised)	R^2	Adjusted R^2	Adjusted R^2 Change	Standard Error .E	F Regression.	F. Significant*
X_2	1	0.327	0.488	0.486	0.486	0.462	166.17	0.000
X_5	2	0.259	0.542	0.536	0.050	0.438	102.19	0.000
X_3	3	0.248	0.563	0.555	0.019	0.429	73.79	0.000

n=200 ***p<0.05*

Dependent Variable **(Y)** = Perceived impact on livelihood

X_2 =Fertilizer Application

X_3 =Fungicide Application

X_5 =Harvesting, Fermentation and Drying technologies

Regression Equation (from unstandardised Beta)

$Y = 0.657 + 0.264 X_2 + 0.186 X_3 + 0.237 X_5$

$Y = 0.657$ if $\beta_2 = \beta_3 = \beta_5 = 0$

Source: Field Survey Data, 2006

The first overall best predictor (fertilizer application) which accounted for the highest (48.6%) explanation in impact on farmers' livelihood happened to be the main thrust of the CHTP. The implication is that application of fertilizer directly affects yield and income of cocoa farmers which will consequently improve other aspects of their livelihood. Edwin and Masters (2003) also reported from survey done in Ghana that the use of fertilizer is associated with 21 percent higher yields. It can be deduced, therefore, that relative increase in yield as a result of the application of fertilizer can contribute significantly to improve or enhance the livelihoods of cocoa farmers.

Farmers' perceived effectiveness of harvesting, fermentation and drying technologies component of the programme was the second variable in the step of entry, which accounted for 5% variance in the perceived impact on livelihoods. This is very understandable because even if farmers had very high yields as a results of the application of fertilizer and other inputs but they do not follow the appropriate technologies recommended for harvesting, fermentation and drying, the quality of the beans would be affected and may not meet the minimum standard in the world market and such beans tend to be rejected. Takrama (2006) reported that though the recommended fermentation period is 6-7 days after opening and turning of the beans in heap at 48 and 96 hours interval, most farmers still use 3-5 days fermentation period in Ghana. Under the CHTP, farmers were to use 6-7 days to ferment their cocoa beans. Results from the study already discussed in Table1 show that about 88% of the respondents used the recommended period of fermentation. The implication is that the beans produced were of the expected quality and, therefore, were not rejected at the buying centres.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The majority of the farmers implemented all the five components as well as the sub-components of the programme. The exception was with the timely 'application of fertilizer where only 42% of the respondents were able to do so. Generally, farmers perceived (each of the five main components as well as the 'whole' programme) to be effective in increasing their yields and incomes and there was fairly high degree of consistency in their views. The programme significantly improved the yields of farmers in the study area. Average farmers' yield increased by 72% three years after the implementation of CHTP of (from 2.85 bags/acre to 4.9 bags/acre), though the increase in yield was below the target of CHTP (10 or more bags/acre**.** The majority (92% of 200 respondent farmers) were able to increase their income as results of the programme. However, less than half (42%) were able to save some of the income generated. Most (88%) of them used the income to settle their debts or pay back part or all the credit they obtained under the CHTP. Few (19%) were able to access credits as results of the programme.

Generally, the level of impact of CHTP on natural and physical livelihoods of farmers was high. Farmers, however, perceived that the level of impact on 3 other categories of livelihoods (financial, human, and social), though high, was not as high as they anticipated. The level of impact of the programme on livelihoods of farmers as a 'whole' though high, was below expectations of cocoa farmers. Improvements in immediate livelihoods of cocoa farmers (i.e. natural and physical) which include yields and farm equipment does not necessarily translate to improvements in other aspect of their livelihoods, namely

financial and human and social which include incomes, savings, access to credit facilities and ability to pay school fees and other social obligations.

All the five main components (cultural maintenance, fertilizer application, fungicide application, insecticide application, and harvesting, fermentation and drying technologies of the programme) correlated significantly (positive) and substantially with impact on livelihoods of farmers. All the five components are, therefore, important to the improvements in cocoa farmers' livelihoods.

The impact of CHTP on livelihoods respondent cocoa farmers who adopted the programme is best predicted by fertilizer application; harvesting, fermentation and drying technologies; and fungicides application with fertilizer application accounting for 48.6 of variances in farmers' perceived impact on livelihoods.

Recommendations

Cocoa Research Institute of Ghana (CRIG) and Purchasing Clerks (PCs) of various Licensed buying Companies (LBCs) involved in the CHTP should collaborate so that the fertilizer would be made available to beneficiary farmers promptly and before the beginning of the rainy season since late application of the fertilizer affects it effectiveness.

Other stakeholders, such as LBCs, Rural banks and Cocoa Processing Companies, should also consider facilitating the adoption of the technologies involved in the CHTP and extend it to cocoa farmers through funding support. This is because the programme was able to increase significantly the yields and livelihoods of farmers who adopted it.

Conscious effort should be made to facilitate the improvement of the human and social capital formation of the farmers since improvement in yield and income do not translate to improvement in social capital formation. This can be done through encouragement and facilitation of the formation of farmer-based organisation (FBOs).

CRIG and other researchers who would want to improve the effectiveness of the CHTP and the livelihoods of cocoa farmers in the region should be guided by the best predictor variables (fertilizer application; harvesting, fermentation, and drying technologies and fungicide application) when developing and recommending technologies to cocoa farmers in the region. More emphasis should also be placed on the overall best predictor variable (fertilizer application).

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