Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.8, No.24, 2017

The Impact of Postharvest Practices on the Poverty Status of Smallholder Cocoa Farmers. The Case of Ellembelle District in the Western Region of Ghana

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Abstract
Although Ghana is a major supplier of premium cocoa beans to the world market, low quality cocoa bean production by small scale farmers due to poor post-harvest practice can result in low annual income. This study was conducted to examine the effects of post-harvest practices on smallholder cocoa farmers' poverty status in the Ellembelle district in Ghana**.** A total of 138 farmers were randomly sampled. With a poverty line at 50 percent of the national mean annual household income, the results indicate that 29.7 percent of the respondents are poor and the rest, 70.3 percent, are non-poor. Logistic analysis results reveal that two main variables, the number of days beans are fermented and the frequency that beans are turned during fermentation, are positive and significant in predicting the respondent's financial ability to meet basic household and farm enterprise needs. Since all of the surveyed respondents failed to turn the beans for the required number times during heap fermentation, further training for the farmers on this technical competency is recommended.
Key words: Postharvest practices, cocoa bean quality, annual income, poverty status.

1.0 Introduction

1.1 Background

Cocoa is the main cash crop in Ghana and the country currently has an annual cocoa production of around 600,000 tons. The country's cocoa is of a high quality and is used as the world standard, attracting a premium price on the world market (Mingle, 2010). Cocoa contributes to about 30 percent of all revenue from exports and about 57 percent of overall agricultural export (Mingle, 2010). Ghana has supplied 98% grade I cocoa beans of her total cocoa production to the world market over the years until the 2003/2004 cocoa season, when the quality of Ghana cocoa beans started to decrease (Aquah, 1999). Even though the current grade status of Ghana's cocoa beans is over 80 percent grade one, the country still stands a chance of reaching 100 percent or close to 100 percent if proper attention is paid to post harvest practices that can affect bean quality. Apart from its contribution to the national export revenue, cocoa is the major source of income for many people in Ghana (Mingle, 2010). It is estimated that about eight hundred thousand farmer families are involved in cocoa production and about two million hectares of land are used in the cultivation of cocoa in the country. The sector directly and indirectly employs about two million people (Mingle, 2010). While chocolate manufacturing companies are competing for higher profits, millions of the cocoa farmers bear the costs by getting increasingly lower shares from the revenues. In 2014, the total global retail value sales of chocolate confectionery reached a staggering 100 billion dollars. In spite of this glowing achievement, cocoa farmers receive a very small percentage of the revenue generated by chocolate manufacturing companies across the globe through the sale of chocolate bars (Egu, 2009). A study by Asamoah, Ansah, Anchirinah, Aneani and Agyapong (2013) on the standard of living of Ghanaian cocoa farmers reveals that 7.4 percent of the sampled population of 637 was extremely poor, with a total annual expenditure of less than GHc443.61, while 11.4 percent were poor with less than GHc397.00. Folayan (2010) underscored the fundamental causes of poor quality cocoa beans as including poor farm management practices, diseases and pest infestation as well as poor post-harvest practices. In recent years, many cocoa farmers have benefitted from programs implemented by COCOBOD, the Ghana Cocoa Board and the governments of Ghana have had the aim of improving farmers' farm management practices as well as reducing diseases and pest infestation. Specifically, the programs included the mass spraying of cocoa farms, provision of a free, subsidized, fertilizer improved variety of cocoa seedlings and training on agronomic practices for cocoa farmers. However, poor post-harvest practice remains a major challenge to cocoa bean quality (Folayan, 2010; Mingle, 2010). Sometimes, bags of cocoa beans fail quality tests because the beans are not well dried, not of uniform size, or simply defective. For instance, in the 2004-2005 season, after six weeks of purchases, only 15% of all cocoa purchased by the Produce Buying Company (PBC), a subsidiary of COCOBOD, met minimum quality standards. In the 2005-2006 and 2006-2007 seasons, less than 10% of the cocoa purchased by PBC met international premium quality standards. The rejected beans are often sold at a discount to domestic manufacturers. Despite forecasts that the demand for cocoa will rise by nearly 20% in the coming years, many farmers can no longer cover their living costs. The low and insecure income of farmers leads to serious livelihood conditions for the farm families (Asamoah et al., 2013; Egu, 2009). It is crucial to

examine how post-harvest practices may influence the economic status of these farmers in order to sustain farmers' interest in the cocoa business. This study therefore aims to examine the impact of post-harvest practices on smallholder cocoa farmers' poverty status in the Ellembelle district in the Western Region of Ghana**.**

2.0 Literature Review

2.1 Classification of Cocoa Bean Quality

Cocoa bean quality is a major factor that influences farmers' annual income. The international cocoa market defines quality by four main terms including physical quality, bio- chemical quality, process quality and origin quality (Folayan, 2010). The bio-chemical quality of cocoa beans focuses on butter content, flavor, toxic compounds and the level of chemical residue left on the beans. The process quality of cocoa beans refers to the production process of cocoa in terms of whether organic or inorganic methods are employed or whether child labor is used. The physical quality of cocoa beans relates to its moisture content, disease infestation, defectiveness, moldiness, and the presence of foreign matter. Of these, the current study is focused on the physical quality of cocoa. Both the domestic and the international market enforce physical quality standards because they are easier to assess prior to export. By Ghanaian standards, a bag of cocoa beans in classified grade I cocoa, if the beans are well fermented, have a moisture content no higher than 7.5% and do not contain more than 3% of beans with defects. Grade 11 cocoa is comparable to international premium quality standards that accept 4-8% beans with any of the other defects, in addition to good fermentation, and not more than 8.5% moisture content. According to Folayan (2010), poor quality cocoa may lead to arbitration cases, loss of market share and revenue as well as tarnish the reputation of the exporting country.

2.2 Major Factors Affecting Cocoa Bean Physical Quality

Major factors that are likely to influence cocoa bean physical quality include the individual socio-demographic background, fermentation technology, and technical factors as well as institutional and information problems.

Individual Socio-Demographic background

The socio-demographic background of the smallholder cocoa farmers that are likely to influence the physical quality of cocoa beans and consequently their poverty status, training experience, and outcomes include their individual education level, gender, age, and years of farming experience (Asamoah, Ansah, Anchirinah, Sneani & Agyapong, 2013).

Technology and Technical factors

Different fermentation technologies such as heap tray methods are employed by cocoa farmers. Fermentation is the development of the chocolate flavors by the activities of microbiological, enzymatic and chemical agents over a period of time on the cocoa beans (Folayan, 2010; Schwan & Wheals, 2004). The presence of relatively high amounts of flavonoids and anthocynidines which are contributory factors for the extreme bitter, acidic and astringent tastes are drastically reduced through good fermentation to levels acceptable to industry. The presence of grey or slaty beans is an indication of poorly fermented cocoa. Germinated beans which are regarded as defects due to physical and physiological changes to the bean have the potential to increase the amount of mouldy beans due to the susceptibility to microflora infection. The heap fermentation method is practiced by most small scale cocoa farmers, whereby the seeds are placed on a carpet of banana or plantain leaves and these are placed on a bed of branches of cut trees, which helps the surplus liquid to drain away easily. The mat of the banana leaves are punctured to allow holes for easy drainage of the pulp. The heap of cocoa beans is also covered with more leaves to protect the fermenting cocoa beans from surface drying and mould growth, and this helps to maintain the heat generated within the heap. Generally, the heaps are fermented for 5-6 days but in Ghana, farmers are advised to ferment for six days, turning the heap twice on the second and fourth days to allow adequate aeration and also to ensure uniform fermentation of the beans in order to obtain the required chocolate flavor (Zahouli et al., 2010; Wood and Lass, 1985). The boxes or trays for fermentation of cocoa beans come in various shapes and sizes, with attendant degrees of effectiveness of yielding the preferred fermentation results of marketable cocoa of premium quality. A typical box has a square base of length 1.2 meters and depth 0.9 meters to hold 1 ton of wet beans, and has perforations of 15 mm diameter at 10 to 15 cm intervals at the floor to allow for aeration and flow of sweating. Various arrangements are possible, such as rows, cascades, vertical, or columns. Trays can be stacked one on top of the other up to twelve high. Based on field trials carried out on the Amelonado type of cocoa in Ghana, a four day treatment gave a superior result to that of normal heap fermentation using banana leaves (Zahouli et al., 2010; Dongo, Bandyopadhyay, Manjula & Ojiambo., 2008).

Technical factors

There are important technical practices that need to be given great consideration when using cocoa fermentation to achieve high quality beans. The right time to harvest is preferably when the cocoa pod is fully ripe on the tree

and this is evident by the pod showing a completely pale to deep yellow coloration. Overripe pods may suffer pest and disease attacks and also the depletion of vital contents due to advancement in senescence. The seeds may germinate inside the pod and the weight reduced as a result, as well as the commercial value. Unripe pods often tend to be smaller, contain less fat and therefore yield poorly fermented beans with an unfavorable aroma (bitter and astringent) referred to in commerce as "Slaty bean" due to the lower sugar content of the mucilage surrounding the bean at this stage. The storage of cocoa pods before the beans are removed for fermentation has been found to promote quality fermentation outcomes (Sanusi and Oluyole, 2005). A study by Afoakwa., Paterson, and Fowler (2011) on Ghanaian cocoa revealed that the storage of cocoa pod for five days after the harvest enhances the fermentative quality of the beans.

Extension/training service
Agricultural Extension is any non-formal education of the rural populace with the aim to bring about a change in the knowledge, attitudes, skills and practice and/or improve the standard of living of rural people (FAO, 2001; Axinn, 1988).

3.0 Methods

3.1 Study Area

This study was carried out in the Ellembelle district, which is one of the seventeen districts in the Western Region of Ghana. The district is located on the southern end of the region between longitudes 2º05' and 2º35' West and latitudes 4º40 and 5º20 North. The district is bounded in the south by the Gulf of Guinea, in the north by part of the north eastern part of the Axim municipality and the Wassa Amefi west district, in the west by the Jomoro district, and in the east by the River Ankobra. It covers a total area of approximately 1,468 of the total land mass of the Western Region. The district lies within the wet semi-equatorial climate zone and experiences rainfall throughout the year, with the highest monthly mean occurring around May and June. The average temperature in the district is about 29.4 degrees Celsius with variation in mean monthly ranging between 4-5 degrees throughout the year. The vegetation is made up of the moist semi-deciduous rain forest in the northern part but turns into secondary forest as one moves southwards, mainly due to human activities. There is also approximately 70km of coastline which is mainly made up of savanna vegetation. The district had a population of 107,673 as of 2010. Farming is the main occupation of the district's populace, with cocoa being the predominant tree crop now grown as a result of the devastation of the coconut crop by the deadly lethal yellowing disease. Other tree crops of economic importance include oil palm, rubber, and citrus. The major food crops are cassava, plantain, rice, and vegetables such as garden eggs, pepper, and tomato.

3.2 Data

This study made use of primary cross sectional data collected from cocoa farmers in the Ellembelle district. Data on farmers' characteristics, training services and fermentation practices were collected from 138 cocoa farmers in 2016. Convenience sampling was used to select two of the notable cocoa farming communities, Kotokum and Nzema Akropong, in the Ellembelle district. A simple random sampling was then used to select 138 smallholder cocoa farmers from the registered cocoa farmers.

4.0 Results and Discussion

4.1 Socio-Economic Characteristics of Respondents

The summary of the descriptive statistics of the socio-economic characteristics of survey respondents is provided in Table 1.

Demographic characteristics
The mean age of the farmer respondent was 43.73 years (Table 1). The ageing of farmers in the cocoa sector is an increasing concern in Ghana. Fortunately, the mean age of the respondent is less than 50 years, lower than reported in previous studies. Males constituted 96 percent of the respondents while females were four percent, which just confirms the traditional trend that more males are more dominant in cocoa production (Asamoah et al., 2013). Statistics on educational attainment show that the sample respondent had on average 4.93 years of schooling. The detailed statistics indicate that a majority (62%) of the respondents had no formal education and/or up to primary school education while 30.4 percent had completed senior high school education. This confirmed that Ghanaian cocoa farmers still have a low level of education. The respondents' education level could have implications for the training effectiveness and outcomes of post-harvest handling cocoa to produce quality cocoa beans. All the respondents indicated that cocoa farming is their main occupation and major source of income. The average land for cocoa farming is 5.80 acres, indicating the respondents were engaged in small-scale cocoa farming. The farmers have been exposed to cocoa farming for a long time, as the results showed that the respondent had on average 14 years of farming experience. The bags of cocoa beans sold last year by each

respondent were used to compute his or her total annual income. The mean annual total income of a respondent from the cocoa sale was GHc12,529.93. This value is somewhat below the national mean annual household income, GHc16, 644.59, for Ghana.

Extension/training service

Extension/training services play a critical role in influencing farming practices and the adoption of technology by farmers (FAO, 2001; Swanson et al, 1997). The results from table 1 show that each of the sampled respondents received some form of extension training on cocoa fermentation. Surprisingly, only seven percent of the respondents indicated that they had the opportunity for hands on practice during the training on cocoa fermentation. Participation as an activity involves a facilitator and a group of people trying to arrive at a constructive group behavior, which leads to making informed decisions for actions. Axinn (1988) emphasized that agricultural extension organizations should encourage participation by rural people, since it arouses interest in the locals and increases people's sense of responsibility. The results from the data analysis also showed that agricultural extension agents visited the respondent only 2.8 times in years. It could be concluded that the training delivery strategies used by the trainers, such as the frequency of contact between the trainers and the trainees, and trainees' hand on participation during the training on fermentation, were not efficient and this could lead to poor adoption and use of the specific training techniques for fermentation.

Post-Harvest Practices

Thus, the level of farmers' income from cocoa sales is influenced by the quality of their cocoa beans (Folayan, 2010; Schwan & Wheals, 2004). Proper postharvest handling of cocoa beans is a major factor that can result in high quality cocoa beans. The technical competencies required for fermenting cocoa beans to obtain quality beans include the harvesting of well-ripe cocoa pods, the storing of harvested pods for five days prior to the breaking of pods, turning the beans twice on separate days during fermentation, and fermenting cocoa beans for six days. Respondents were asked about their use of knowledge and skills provided them during training on cocoa fermentation. As shown in Table 1, all the respondents harvested fully grown cocoa pods. The farmers' harvesting of well ripe cocoa pods is an essential requirement to ensure the production of quality beans. As indicated in Table 1, the respondents stored the pods on average for 2.3 days and this might affect their cocoa bean quality. Storing the cocoa pod allows the pulp volume per seed to decrease as a result of water evaporation and inversion of sucrose **(**Schwan & Wheals, 2004**)** and a decrease in total sugar content that ultimately helps to reduce acid production during fermentation. The result of the descriptive statistics showed that the respondents turned the beans on average for .34 times. With the heap method, the beans needed to be turned on the second and fourth days to allow adequate aeration and also to ensure uniform fermentation of the beans in order to obtain the required chocolate flavor (Zahouli et al., 2010). However, it was encouraging to note that the respondents fermented the beans for 6.26 days (Table 1). With the heaps method, cocoa beans are generally fermented for 6-7 days in order to obtain the required chocolate flavor (Zahouli et al., 2010). In analyzing the post-harvest practices of the respondents, the respondents demonstrated proper application of the technical competencies in relation to harvesting fully grown cocoa pods and fermented the cocoa beans for six days. On the downside, the respondents stored the harvested pods on average for 2.3 days instead of five days and turned the fermenting beans on average 0.34 times instead of twice, as required for two different days. The failure of the survey respondents to properly apply the technical competencies they were taught might have had a negative effect on the quality of the cocoa beans produced. According to a cocoa purchasing clerk in the study area, their record indicated that about 36 percent of the cocoa farmers sold less than grade 1 cocoa beans.

Table 1: **Descriptive Statistics of Socio-Economic Characteristics of Respondents**

Variable	N	Minimum	Maximum	Mean	Std Deviation	Median
Farmer characteristics						
Gender(male=1,female=0)	138	0.0	1.00	.96	.19	1.00
Years of schooling	138	.00	16	4.93	4.57	6.00
Experience with farming (years)	138	2.00	32.00	14.00	6.50	13.00
Total acreage cropped	138	2.00	14.00	5.80	2.33	5.00
Total annual income from cocoa sale (Ghana cedi)	138	1880.00	34,780.00	12,529.93	7035.34	10,340.00
Training						
Training farmers on cocoa fermentation (1,0)	138	1	1	1	.00	1
Farmer hand on practice during training (1,0)	138	0	1	.07	.25	0.00
Number of visit by extension agent (per year)	138	1	4	2.8	.49	3.0
Post harvest practices						
Cocoa pod harvested well ripe (1,0)	138	1.00	1.00	1.00	1.00	1.00
Days to store pods prior to breaking cocoa pods	138	1	3	2.3	.57	2.00
Times turned beans during fermentation	138	0	1	.34	.48	.00
Days cocoa beans were fermented	138	5	7	6.26	6.00	.53

4.2 Poverty Status of Respondent

This study aimed to examine the impact of smallholder cocoa farmers' post-harvest practices on their poverty status in the Ellembelle district in the Western Region of Ghana**.** Income is a fundamental measure of a person or household's poverty or economic well-being. A renowned economist, Sachs (2005), cautioned that the poverty lines adopted for nation-wide poverty studies in Ghana are usually too rigid, skewed, very low, and unacceptable since they usually do not reflect the socio-economic situations on the ground. In line with international practice, the current study operationalized and measured the poverty status of respondents based on the Luxembourg Income Study (LIS) (LIS, 2006). The LIS defines and measures poverty internationally based on social exclusion poverty and it classifies a person or household as poor when his income is below 50% of the mean or median income of his country. The LIS poverty measurement shows the relative position of the individual in society with regard to their national mean or median income. For many years, the LIS definition and measurement of poverty has been used by many countries and international development agencies (LIS, 2006). The total income of each of the respondents were scored 1 if their total income was less than 50% of the national mean annual household income, otherwise they were scored 0. The national mean annual household income in Ghana was GHc16.644.59 (GSS, 2014). Analysis of the survey data with the poverty line at 50% of the national mean annual household income, GHc16,644.59, indicated that 29.7 percent of the respondents were classified as poor and the rest - 70.3 percent - were non-poor (Figure 1). Relative income discrepancy reveals the distribution of income of inequality between the surveyed respondents and the average Ghanaian population.

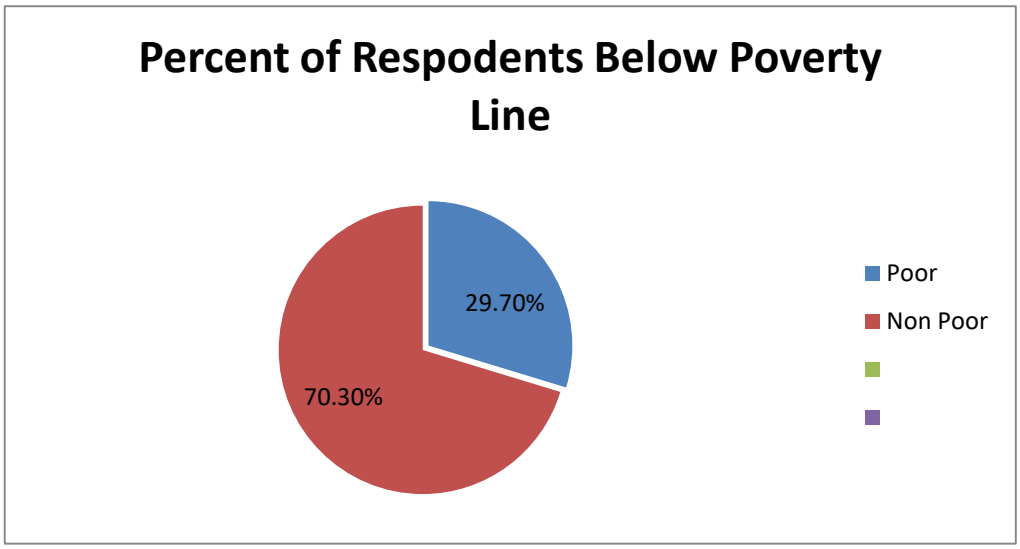

Figure 1: Percent of Respondent Below Poverty Line

To measure the level of surveyed respondents' financial ability to meet their basic household and farm enterprise needs, they were asked to respond to a six item sequence statements summated scale (Alpha reliability=.87). The statements asked about their financial ability to meet basic household needs include hospital bills, food, school expenses, and utility bills as well as the purchasing of basic farm inputs and paying for farm expansion. The response options ranged from very difficult (1), difficult (2), not sure (3), and easy (4) to very easy (5). As shown in Table 2, the survey respondents on average could be placed in the middle of the five scales from very difficult to very easy regarding his or her financial ability to meet basic household and farm enterprise needs.

Table 2: Respondents' Ability to Meet Basic Household and Farm Enterprise Needs

	Mean	Median	Min	Max	SD	Skewness
Respondent's level of financial ability	3.40	3.33	2.33	5.00	.65	.39

4.3 Estimation of Factors Influencing the Probability of Respondents Meeting Basic Needs

Dependent variable:
Low quality cocoa beans normally attract a low price and this could eventually lead to a low annual total income for small scale cocoa farmers. Such a situation creates difficulties for many farmers in covering their basic household and farm enterprise needs (Asamoah et al., 2013). In this study, the dependent variable is the financial ability of the cocoa farmer to meet basic household and farm enterprise needs. Farmers who score highly on this variable are coded 1, otherwise 0.

Predictor variables
The probability of the farmer's financial ability to meet basic household and farm enterprise needs with ease is influenced by predictor variables that can be categorized into three different areas: demographic characteristics, training service, and post-harvest practices, as shown in table 1. The study utilized a multivariate logistic analysis. All the predicted variables in table 1 were not included in the final regression. This was due to a lack of statistical significance, unexpected sign on the estimated coefficient, and relationship and multicollinearity issues. The core predictor variables are gender, number of extension staff visits, opportunities for farmers to practice during training, number of days for fermenting beans, and frequency of turning beans during fermentation. An initial analysis to determine the association between the dependent and predictor variables was performed, and the bivariate relationship among the predictor variables was conducted to determine their tolerance levels (Pallant, 2013). The computed variance inflation factor values associated with each of the predictor variables show low VIF values, with a range of 1.027-1.103. These values indicate the nonexistence of multicollinearity among the predictor variables (Table 3). There is an association between the dependent variable and the predictor variables. Almost all the associations are significant (Table 4).

Table 3: Collinearity Statistics on Predictor Variables

Variables	Tolerance	VIF
Gender	.907	1.103
Number of Extension visit (per year)	.974	1.027
Farmer hand on practice during training	917	1.091
Number of times beans were turned during fermentation	.908	1.101
Number of days for fermenting beans	.913	1.095

Table 4: Relationship Between Dependent and Predictor Variables

Variables	Sign	Significance
Gender	.Ambiguous	
Number of Extension visit (per year)	+	*
Farmer hand on practice during training	+	
Number of times beans were turned during fermentation	+	***
Number of days for fermenting beans	+	**

Significant for coefficients: *p**<.05; *p***< .01; *p****< .001

By using a standard regression logistic method, the result of the final logistic model,

$$\text{Logit}(P) = \text{In}(P/1\text{-}P) = \beta o + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5$$

indicates that two factors significantly affect the likelihood of the cocoa farmer's financial ability to meet basic household and farm enterprise needs (Table 5). These include the number of days for fermenting beans and the frequency of turning beans during fermentation. As expected, there is a positive and significant relationship between these two variables and the cocoa farmer's financial ability to meet basic household and farm enterprise needs. This could be explained by the fact that fermenting the cocoa beans for a number of days (seven) and turning the beans twice during the fermentation period would lead to quality cocoa beans that attract a higher income. The other variables that positively influence the likelihood of the farmer's ability to meet basic needs with ease but were not statistically significant included gender, the number of extension staff visits and the opportunities for farmers to practice during training. A good-fitting logistic model requires that the Hosmer and Lemeshow statistics be greater than .05 (Hosmer and Lemeshow, 2010), and this is true for the two models used here. The adjusted R squared, 18.4, indicated that the variation in the predictor variables explained 18 percent of the probability of the farmer to meet basic household and farm enterprise needs with ease.

5.0 Conclusion and Recommendations

The smallholder cocoa farmers' knowledge and skills in the post-harvest practices, such as fermentation of cocoa to produce quality beans, is crucial. Low quality cocoa beans normally attract low prices and this eventually affects farmers' take-home income and livelihood conditions. The study reveals that all the respondents failed to turn the beans twice during fermentation. The failure of the survey respondents to properly apply the technical competencies they were taught might have had a negative effect on the quality of the cocoa beans produced, hence leading to a low annual income and the reduced ability of some cocoa famers to meet their basic needs. It is recommended that further training be provided to the farmers.

Table 5: Logistic Regression of Predictor Variables on Respondents' Ability to Meet Basic Needs

Independent Variables	*B* (S.E.)	Odds Ratio	95% C.I. for EXP (B). Lower	Upper
Gender	1.204(1.132)	3.333	.363	30.631
Extension visit (per year)	-.595(.393)	.551	.255	1.191
Farmer hand on practice	1.689(.951)	5.415	.839	34.931
Times beans were turned	.977(.401)	2.656**	1.209	5.834
Days beans fermented	.706(.362)	2.026*	.996	4.123
Constant	-4.487			
-2Log-Likelihood	170.320			
N	138			
Pseudo R Square	.184			
Hosmer & Lemeshow Goodness-of-Fit Prob >chi2=	.060 .001			

Significant for coefficients: *p**<.05; *p***< .01; *p****< .001

Reference

Acquaah B. (1999). Cocoa development in West Africa. Ghana: University of Ghana Press.

Afoakwa, E.O., Paterson, A. & Fowler, M. (2011). Factors influencing rheological and textural qualities in chocolate – a review. *Food Science and Technology 18*, 290-298.

Afoakwa, E.O. (2007). *Chocolate science and technology*. UK: Wiley-Blackwell Publishers.

Asamoah, M. Ansah, F., Anchirinah, V., Aneani, F. & Agyapong, D. (2013). Insight into the standard of living of Ghanaian cocoa farmers. *Greener Journal of Agricultural Sciences 3(5)*, 363-370.

Axinn, G.H. (1988). *Guide on alternative extension approaches.* Rome: FAO

Dongo, L.N., Bandyopadhyay, R., Manjula, K. & Ojiambo, P. (2008). Occurrence of Ochratoxin in Nigerian 'ready for sale' cocoa beans. *Agricultural Journal 3(1)*, 4-7.

Egu, F.K. (2009). Fairtrade and cocoa price stability in Ghana. Retrieved at www.ghanaweb.com/GhanaHomePage/NewsArchive/Fairtrade-and-cocoa-price-stability-in-Ghana-161452

FAO (2001). *Agricultural and rural extension worldwide. Option for institutional reform in the developing countries.* Rome: FAO

Folayan, J. (2010). *Nigerian Cocoa and Cocoa Byproducts: Quality Parameters, Specifications and the Roles of Stakeholders in Quality Maintenance. Pakistan Journal of Nutrition. 9.*

Ghana Statistical Service (2014) *Ghana living standard round 6.* Accra: Ghana Statistical Service

Ghana Statistical Service (2014) *2010 Population and housing census: District analytical report, Ellembelle District.* Accra: Ghana Statistical Service

Hosmer, D & Lemeshow, S. (2010). *Applied logistic regression.* New York: Wiley.

LIS (2006). *LIS: Introduction.* Retrieved at http://www.lisproject.org/introduction/history.htm

Mingle, J. (2010). *Ghana strides in cocoa production.* Ghana: Ghana Broadcasting Co-operation.

Pallant, J. (2013). *SPSS survival manual: A step by step guide to data analysis using SPSS window.* New York: McGraw Hill.

Sachs, J. (2005). *The end of poverty: Economic possibilities for our time.* New York: The Penguin Press.

Sanusi, R.A. and Oluyole, K.A. (2005). An Analysis of Cocoa Production and Export in Nigeria (1930-2003). *Bulletin of Science Association of Nigeria., 26, 146-154..*

Schwan, R. & Wheals, A. (2004). The microbiology of cocoa fermentation and its role in chocolate quality. *Critical Reviews in Food Science and Nutrition, 44(4)*:205-21

Swanson, B. E. et al (1997). *Improving Agricultural Extension.* A Reference Manual: Rome:FAO.

Wood, G. A. & Lass, R (1985). *Cocoa*. United Kingdom, London: Longman Group Limited.

Zahouli, I., Tagro, G., Fae, M., & Ban-Koffi, L & Nemlin, J. (2010). Effect of drying methods on the chemical quality traits of cocoa raw material. *Advance Journal of Food Science and Technology. 2, 4,* 184-190,