International Journal of Economics, Commerce and Management
United Kingdom ISSN 2348 0386 Vol. VII, Issue 5, May 2019

http://ijecm.co.uk/

AN EMPIRICAL INVESTIGATION OF THE DETERMINANTS OF COCOA PRODUCTION IN THE SOUTH WEST REGION OF CAMEROON

Joseph Tosam Ngong
PhD Student, Department of Economics, University of Bamenda – Cameroon
jtosam@yahoo.co.uk

Akume Daniel Akume
Associate Professor of Economics, Higher Teacher Technical Training College (HTTTC)
University of Buea – Cameroon

Njimanted Godfrey Forgha
Professor of Economics, Higher Institute of Transport and Logistics (HITL)
University of Bamenda – Cameroon
unicalub@yahoo.com

Vukenkeng Andrew Wujung
PhD, Higher Institute of Commerce and Management (HICM)
University of Bamenda - Cameroon

Abstract

Cocoa production continues to remain the lifeblood of rural households in all cocoa growing communities in the South West Region of Cameroon with over 90% of the population in these communities involved in its production. However the determinants of cocoa production have over the years remain an issue of much controversy. This paper therefore investigates the determinants of cocoa production in the South West Region of Cameroon. A total of 430 questionnaires were distributed to cocoa farming households with the use of the multi-stage sampling technique in all the six Divisions that make up the South West Region. Using the

Principal Component Analysis (PCA) and the path regression the study revealed that access to credit and perceived climate variability has a negative significant effect on cocoa production whereas the use of fertilizers and chemical spray of the farm has a positive significant effect on cocoa production. The effects of marital status, farmers' involvement in non-governmental organizations and government assistance were insignificant. The study thus recommend; the creation of village banks that would provide loans to farmers in the form of inputs rather than money; the introduction of improved cocoa species which are more productive and adaptive to the current and highly unpredictable climate scenario and increased government assistance among others.

Keywords: South West Region, Determinants, Cocoa Production, Agriculture

INTRODUCTION

In the 21st century, agriculture continues to be a potential source of development and poverty reduction for most developing countries particularly Cameroon, World Development Report (WDR, 2008). The South West Region remains one of Cameroon's bread baskets in terms of agricultural production (Chambon and Mokoko, 2013). Over 70% of the inhabitants in the Region are living in rural areas and are involved in agricultural activities, with over 38% of the total surface area under cultivation (MINADER, 2013). This agricultural strength comes principally from the export crop sector, which is based on cocoa, coffee, timber, banana, rubber and palm oil, with cocoa as the leading subsector. Approximately 14 million rural workers directly depend on cocoa for their income, and this crop provides a livelihood for between 40 – 50 million farmers, rural workers and family members worldwide (WCF, 2012; Cocoa Barometer, 2014; Gayi and Tsowou 2015).Globally, an estimated average of 3 million metric tons of cocoa are produced every year (UNCTAD, 2004). Africa, particularly West Africa is the largest producer of cocoa, accounting for over 70 per cent of global production. Côte d'Ivoire and Ghana alone contribute over 60% of the global cocoa supply, while Nigeria and Cameroon accounts for 12% (ICCO, 2013; Gayi and Tsowou 2015).

Cameroon is Central Africa's leading producer of cocoa, Africa's fourth largest producer as well as the 5th world largest producer. There are two main production basins in Cameroon; the South West basin and the Centre-South Basin (Klarer, 2014). Over the past 20 years the national production has been on an increase as well as the surface area planted of cocoa (FAO, 2014). Cocoa production rose from about 125,000 tons in 2000 to approximately 256,000 tons in 2012 and 275,000 tons in 2017(Drum Commodities, 2012; FAO, 2014; MINADER, 2018).

This implies that output growth between 2000 and 2017 was approximately 150,000 tons. This increase as compared to that in Côte d'Ivoire which moved from 1.2 million tons in 2000 to about 1.8 million tons in 2017 (that is a 600,000 tons increase) is too insignificant. Thus, the growth of cocoa production in Côte d'Ivoire between 2000 and 2017 was 4 times that in Cameroon (WCE, 2014).

Cameroon earns about 250 billion CFA francs (308.6 million pounds) a year from cocoa. This accounts for about half of the country's primary-sector exports, National Cocoa and Coffee Board, (NCCB, 2013).Cocoa remains one of the main cash crops in Cameroon with about 460.000 hectares of land used for growing it and over 600,000 people involved in its production. There are approximately 250,000 cocoa farms with about 60 percent of the population in Cameroon depending directly or indirectly on cocoa for their livelihood (FAO, 2005; Klarer, 2014).From 2003 to 2007, the cocoa sector's contribution to Cameroon's GNP moved from 0.89% to 1.45%. This accounted for between 5 to 9.652% of annual total export revenues. In 2009, cocoa accounted for 15% of the country's total annual export and 2.2% of the country's GNP (Armathé et al., 2013). As of 2011, national income from cocoa exports was the highest of all agricultural products (FAO, 2014).Cameroonian cocoa is the most sought after brands of cocoa in the world. This is a big boost to cocoa production in Cameroon (Uba, 1998; Iyabano, 2012).

Despite these contributions to the economy and the dependence of Cameroonians on cocoa, the sector is facing lots of difficulties that are affecting its long-term viability (Tchokote et al., 2015). Increasing the quantity and quality of cocoa produced is one of the major focus of the government of Cameroon as they affect the export price as well as income realize from cocoa sales. This has led some to comment on the sluggish increase in the quantity of cocoa produced in Cameroon (FAO, 2012). This is a major issue of concern in the South West Region, one of the main cocoa producing basins of the country.

The South West Region is the highest cocoa producing Region in Cameroon, producing over 58% of the country's total production (MINADER, 2012; FAO, 2014). This puts the South West Region at the forefront as far Cameroon's cocoa production is concerned. Over 90% of households in the cocoa producing areas of the south west region depend on cocoa for their income. It is with this income that members of these households are expected to get shelters for themselves, feed, cloth, educate and provide health care for their families (Klarer, 2014). Incomes realized depend to a very large extent on the quantity of cocoa produced. This quantity of cocoa is governed by both natural and human factors, United Nations Environmental Program (UNEP, 2013). However, the empirical findings has continued to generate controversies among scholars, with no profound empirical answer with reference to the

appropriate factors that are likely to influence cocoa output in Africa, Cameroon and the South West Region in particular (Fadipe et al., 2012; Forgha and Tosam, 2013 and Effah et al, 2017).

Production in the South West Region moved from 145,039 tons in 2010 to about 188,329 tons in 2015, implying that cocoa production has risen in South West Region (SWR) in the past years, with output, averaging about 425 kg per hectare (Drum Commodities, 2012. The increase in output does not mean the area is spared from the adverse effects of climate and other socioeconomic factors on cocoa production. According to Klarer (2014) the increase in output is merely due to increase in more land that has been brought under cultivation and not as a result of increase in output per hectare.

This Region is the most fertile and has the highest output per hectare in Cameroon. However, the output per hectare of 425 kg/ha in the South West Region remains greatly below expectation as compare to output per hectare in other cocoa producing countries such as Cote d'Ivoire (600kg/ha), Indonesia (1000kg/ha) and Malaysia (1800kg/ha) (Abekoe et al. 2002; Cobbina, 2014 and Fule, 2013). This poor output per hectare could be attributed to the effect of some natural and human factors. Due to this low output, cocoa farmers do not earn sufficient income to meet their needs and maintain a moderate standard of living. The result of this are negative consequences such as, rural exodus of the youths and working age population who are leaving cocoa farming to pursue better opportunities in cities or abroad. Most of the cocoa farming communities are therefore left with a greater percentage of the population made up of old and children with very low productive capacities. This contributes to poor health conditions, prevalence of diseases especially HIV/AIDS, malaria and hunger, increasing child labor, little or no child education and increased poverty, among the households of the cocoa farmers. This therefore endangers the cocoa sector that plays a vital role in economic growth of Cameroon and on which thousands of rural families depend for their livelihoods in the South West Region.

Hence, it is imperative to identify the factors that significantly affect cocoa production in the South west region so that the farmers and other stakeholders can engage in influencing or adapting with these factors so as to improve output and as well as their welfare. This therefore calls for an investigation into the determinants of cocoa production in the South West Region of Cameroon so as to ascertain the factors affecting cocoa production and thus seek ways and means through which output can be improved. Specifically this work seeks to; identify the socio economic characteristics of cocoa farmers in the South West Region; examine the natural and physical factors affecting cocoa production and suggest plausible recommendations through which output can be improved.

This paper is divided into five sections. Section one is the introduction, section two is literature review and section three is the research methodology. Section four is results and section five contains the conclusion and plausible recommendations

LITERATURE REVIEW

Richman (2010) carried out an investigation into the determinants of technical efficiency using a balanced longitudinal (panel) data on Ghanaian cocoa farmers for period of 2001 to 2006, and in this study he concluded that both natural and socio-economic factors greatly affect cocoa production. Mubeteneh (2015) in a similar study concluded that changes in the production of cocoa result from a combination of changes in yields and changes in crops acreage as a result of the effect of both climatic (natural) and human factors. These studies are in line with the works of Oyekale and Oladele (2012); Kimengsi and Tosam (2013) and Teal, (2013) who affirm to the fact that physical as well as human factors affect cocoa production. They however attest to the fact that the magnitude and direction of influence of these factors vary depending on time and place.

Kyei et al., (2011) using primary data that was collected through the administration of questionnaires, analysed the basic determinants of technical efficiency, as well as the socio-economic variables that affect the performances of cocoa farmers in the Offinso district in Ghana. Their analysis showed that the model of the production functions was statistically significant at 0.00. This study concluded that the ability to properly use factors such as labour, capital and age of farms would lead to an increase in output.

Muketeet al (2016), in their study assessed the technical efficiency of smallholder cocoa farmers in the Meme division of South West Region of Cameroon. Through descriptive statistics their results showed the technical efficiency to range between 0.11 and 0.99, with a mean technical efficiency of 0.86. They also observed access to credit and extension services to significantly influence technical efficiency in Meme Division. Consequently, innovative institutional arrangements that enhance extension and farmer training, accompanied by improved access to credit could efficiently boost cocoa production in Meme and Cameroon in general. Similarly Mukete et al. (2018) examined the technical efficiency of small scale farmers across Africa particularly Cameroon. Using published scientific literature, they observed that provision of appropriate technical skills and financial access, would sustainably and enormously contribute to the growth of the cocoa sector, improve rural livelihoods and achieve food security. Technical efficiency as indicated by the concept of total factor productivity plays a vital role on the improvement cocoa output. However this is just one of the factors among many that affect cocoa production in the south West Region that this study has taken into consideration.

Aneani, et al (2011) analyzed the extent and determinants of crop diversification by cocoa farmers in Ghana. Using multinomial regression analysis the study found that age of cocoa farm and access to credit were statistically significant (P< 0.05) determinants of cocoa farming diversification. Thus the study recommended that cocoa production can be improved and sustained by convincing farmers to replant old cocoa farms, modernize traditional cocoa farming practices and improve access to credit facilities for farmers.

Ojonimi et al. (2012) assessed the profitability of cocoa farms in Nigeria's largest cocoa producing state and ascertained their profitability determinants. The data analyzed using descriptive statistics, budgetary analysis and OLS multiple regression models, showed that cocoa production is profitable with mean profit of US$10342.93. The determinants were labour, capital, seedlings planted and household size. The study recommends farmers' training through agricultural agencies and the provision of access to credit in order to guarantee sustainable production of cocoa in Nigeria.

Relatedly Fadipe et al., (2012) examined the economics of cocoa production in Oyo state, Nigeria. Descriptive statistics, farm budget analysis, profitability and efficiency ratios and ordinary least square regression were the major analytical tools employed for the study. Results of the analysis showed that a net return of N37, 705.69 per hectare was made in a production season and the profitability and efficiency ratios were 2.33 and 3.33 respectively implying that cocoa production in the study area is profitable and efficient. The study identified farm size, access to credit, chemical inputs and farm age as factors that significantly affect cocoa production in the study area. Thus it therefore recommends the improvement of farm size, making credits available at no or little interest and provision of basic amenities in the rural areas. Forgha and Tosam (2013) assessed the socio-economic determinants of cocoa production in Meme Division of the South West Region of Cameroon. With the use of the Generalized Method of Moments (GMM) and Trend Analysis the study revealed that capital, labour and price had a positive significant effected on the output of cocoa while political influence and gender insignificantly affect output of cocoa. Based on the findings, the study concluded that the observed socio-economic variables affect cocoa production but the degree and direction to which each variable affect output varies. In a similar study Effah et al, (2017) investigated into the determinants of cocoa production in the Ashanti region in Ghana. With Ordinary Least Squares (OLS) estimates from a Cobb-Douglas production function, the study found that the total revenue and hired labour variables had significant influence on cocoa production. Both variables were significant at 1%. On the other hand the number of times of mass spraying and farm size variables were statistically insignificant. These results were contrary to those of

Dorward (1999); Oyekale and Oladele (2012) and Ogunsola and Oyekale (2013) who affirm the significant influence of spraying and farm size on cocoa production.

Many studies/similar works have been carried out on the determinants of cocoa production in the world, Africa, Cameroon and the South West Region as revealed by the literature above. From these studies it is clear that one cannot single out for certain a factor or factors that generally affect cocoa production. Any factor identified by the various studies depends on where and when the study was carried out and the methodology used. Again from the above studies, none has been carried out precisely in the South West Region (SWR) on the Determinants of Cocoa Production. A similar study in this domain by Forgha and Tosam (2013) only looked at the socio economic determinants leaving out natural factors whose influence on cocoa output cannot be overemphasized. The above study was carried out only in Meme Division, one of the six cocoa producing Divisions in the SWR whereas the present study looks at all the six cocoa producing Divisions in the Region. Of all these studies reviewed none has adopted the use of the Principal component Analysis (PCA) and Path Regression technique as the present study; this therefore makes the study very unique.

METHODOLOGY

The study examines the determinants of cocoa production in the South West Region of Cameroon. The Region is bounded to the north by the North West Region, south by the Atlantic Ocean, to the west by Nigeria and in the East by the Litoral region. The region has a population of covered by cocoa production (MINADER, 2013). This study covers all the cocoa producing areas of the six Divisions of the South West Region. The research design adopted here is across-sectional research design which includes both survey and ethnographic methods (Ranjit 1996).

Sources and Methods of Data Collection

This paper made use of primary sources of data. It used a mixed method research design in primary data collection. Structured questionnaire and ethnographic techniques were used in the data collection process. The ethnographic study methods used include interviews and observations.

Sample and Sampling Technique

A random sample of 430 cocoa farming households in the study areas was selected, using the multi-stage sampling approach. The population considered for the study includes cocoa farmers in the South west Region of Cameroon, while the target population was cocoa farmers who are

household heads, engaged in cocoa farming. Multistage random sampling technique was employed to select sample households in the study area. In the first stage the study employed a stratified sampling technique in which the six divisions that make the South West region were carved out, with each division taken as a stratum. The second stage involved a purposive sampling in which the allotment of questionnaires depended on the population of cocoa farmers in each of the stratum. Here, the number of questionnaires to be allotted to each stratum as well as the number of villages in each of this stratum was purposively chosen depending on the cocoa farming population in a stratum.

In the third stage convenient sampling technique was adopted, in which the villages to be sampled were chosen depending on the ease with which the researcher could reach the said village due to the socio political crisis in the study area and ten households were randomly chosen from each of the selected villages. Therefore a total of 43 communities were selected in the entire South West Region. Lists of all the cocoa producing villages/communities were obtained from the divisional and regional delegations of agriculture in the South West Region.

Model Specification

Path regression as well as the Principal Component analysis (PCA) has been adopted in this study. Path analysis is the extension of multiple regressions. It forms the bases of structural equation modeling. This approach to data analysis was adopted because it is easy to understand and to test for relationship between sets of exogenous and endogenous variables. This method of estimation through the maximum likelihood is equally useful in testing for counterintuitive reasons.

i) The conceptual model

The Barnum-Squire farm household model developed by Barnum and Squire (1970) provides a framework for generating predictions on how farm households respond to changes in output and domestic variables (family size and structure) and market variables (output prices, input prices, wage rates and technology) among others. The production function in this model refers to farm output which can be traded not just as home production for direct use. This model is very vital in this study given that cocoa output in the South West Region and Cameroon in general is mainly for sale. The Barnum-Squire production function is stated as:

$Y = f(A, L, V)$……..... *(3.1)*

From the production function above, Y is the output, A is land under cultivation, Lis the total labour input (both household and hired) and Vis other variable inputs used in production.

This study therefore augments this production function by adding some of the variables deemed necessary in this work that the original Banum-Squire model did not take into consideration.

Hence we present an augmented Banum-Squire model thus:

CCP = *f (Zr, Cl, NA)*----------*(3.2)*

Where CCP = cocoa production

Zr= Socio-economic variables (household size, price, farm size (land under cultivation), education of household head, and government assistance, chemical spray and fertilizers, access to credit, involvement in non-governmental organization and marital status).

Cl = Climatic variables such as rainfall and temperature.

NA = Natural factor (soil fertility)

Expanding this model, we have;

CCP = f(HHS, COP, FAS, EHH, GOA, AOF, AOC, TERF,SOF, FERS, NGO, MS).------(3.3)

The equation above shows a functional relationship between the variables household size (HHS), price (COP), farm size (FAS), education of household head (EHH) government assistance (GOA), age of farmer (AOF), access to credit (AOC), temperature and rainfall (RERF), and soil fertility (SOF), chemical spray and fertilizers (FERS), involvement in non-governmental organization (NGO) and marital status (MS) and the construct cocoa production (CCP).

From here the study conducted a pre-test analysis known as principal component analysis (PCA); a Varimax method of extraction used in computing the communalities of the items. Communality captures the percentage of variability in cocoa production. That is, the extent to which each item can explain the variation in cocoa output. The extraction of the communalities shows that each of the items retained for further statistical investigation in this study can at least explained more than 50% of the variance in the regression factor scores. This is therefore the reason why some of the observed variables in our conceptual model will no longer appear in our econometric model below.

ii) Econometric Model on the determinants of cocoa production

$$COCP_i = \beta_0 + \beta_1 GOA_i + \beta_2 \mathrm{AOC}_i + \beta_3 \mathrm{TERF}_i + \beta_4 \mathrm{FERS}_i + \beta_5 \mathrm{NGO}_i + \beta_6 \mathrm{MS}_i + \varepsilon_i \quad \text{---------- (3.4)}$$

Where the subscript i in econometric model 3.4 indicates that the observations across individuals. The parameters were estimated using the maximum likelihood estimation techniques of structural equation modeling using the software Amos 16. The apriori expected sign are as follows;

$\beta_1 > 0$ or $\beta_1 < 0$, $\beta_1 > 0$ or $\beta_1 < 0$, $\beta_3 > 0$ or $\beta_3 < 0$, $\beta_4 > 0$, $\beta_5 < 0$ or $\beta_5 > 0$, $\beta_6 > 0$

ANALYSIS AND DISCUSSION OF RESULTS

Descriptive analysis

It has been observed from the analysis that out of the 374 respondents in this study, 0.3% of them are between the age 5-18 years, 29.4% of the respondent are between the age 19-35 years, 56.4% of the respondents are between the age 36-55 years, 13.9% of the respondents falls between the age of 55 years and above. Thus, majority of respondent fall between the age range of 36-55 years. Cocoa production involves hard work and thus a majority of those involved in this activity are young people between the age ranges of 19 – 35 and 36 – 55. Very few below 19 years (0.3%) and above 55 years (13.9%) are involved in the production of cocoa in the South West Region of Cameroon. In fact, cocoa production is not an activity for children and the old. Intuitively the young should be more productive than the old and children.

The study equally reveals that, out of 374 respondents, 84.5% were male farmers while, 15.5 % were female. This implies that the majority of respondents were males. This is obvious because cocoa farming has traditionally been a male dominated activity and women are just fairly recently engaging themselves it.

Analysis shows that out of the 374 respondents, 6.4% were widowed/widower, 3.2% were divorced, 20.6% were Single and 69.8% were married. In conclusion therefore, a majority of respondents were married. Cocoa production is a responsible activity mostly handled by those who are married. Also family labour plays a vital role in the production of cocoa, thus it is advantageous for a household heads that are married especially one with many children.

It can be viewed that out of the 374 respondents, 12.6% revealed that more than 10 members of their household were dependent. 14.7% had dependents between 6 to 10 members, 46.8% agreed that they had between 3 to 5 dependents, 97 respondents corresponding to 25.9% had dependents between 1 to 2 members. A majority of respondents therefore affirms the fact that most of the households have dependents ranging from 3 to 5 members. This dependency ratio affects the welfare of cocoa farmers which in turn affects the household productive capacity.

It has been disclosed 5% of the farmers sampled had master degree certificates, 5.9% were farmers who had first degree certificates. 17.1% had Advanced Level (A/L) certificates, 15.2% were farmers with Ordinary level (O/L) certificates. 56.4% were farmers with first school leaving certificate (FSLC) and 4.8% had no formal educational qualification. In conclusion, a majority of the farmers (respondents) were those who had First School Leaving Certificate. Most of the farmers in the SWR of Cameroon have little or no education as 60.2% of the farmers were with either no formal education or with FSLC.

The above analysis clearly reveals that; age of the household head, marital status, level of education, dependency ratio and gender of the household head are all socioeconomic characteristics of cocoa farmers in the South west Region of Cameroon. These characteristics possibly affect the farmers' attitude towards cocoa farming, as well as output.

Inferential analysis

The main objective of this paper was to investigate both natural and physical factors affecting cocoa production in the South West Region of Cameroon. In order to achieve this objective the study adopted the Principal Component Analysis (PCA) and path regression.

The Validity Test of the factors determining the Cocoa Production

Table 1: KMO and Bartlett's Test (SPSS 21 output)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.635
Bartlett's Test of Sphericity	Approx. Chi-Square	1402,645
	df	105
	Sig.	0.000

Table 1 shows the results of Bartlett's test for sphericity and the Kaiser-Meyer-Olkin (KMO). The KMO value of 0.635 is reasonable to conduct a factor analysis. The p-value of Bartlett's test (p = 0.000), which is below 0.05, indicates that it is significant at the 99% confidence level. The result of the test equally indicates that the correlations structure is significantly strong enough for performing a factor analysis on the items. The use of principal component analysis in this study is to permit us to construct a factor score and also for dimensional reduction of the number of items on the questionnaire under the variable cocoa production to few meaningful underlying items. Factor scores are obtained through the method of regression using the software SPSS version 21. Factor scores are standard score with mean zero and variance equals to the square multiple correlations between items and factors.

The extraction of the communalities shows that each of the items retained for further statistical investigation in this study can at least explain more than 50% of the variance in the regression factor scores. The result of the communality test is presented in the table 2.

Table 2: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.008	23.142	23.142	3.008	23.142	23.142	2.343	18.025	18.025
2	1.948	14.987	38.129	1.948	14.987	38.129	2.139	16.452	34.478
3	1.540	11.848	49.977	1.540	11.848	49.977	1.648	12.681	47.158
4	1.380	10.617	60.593	1.380	10.617	60.593	1.591	12.242	59.400
5	1.264	9.723	70.317	1.264	9.723	70.317	1.419	10.916	70.317
6	0.756	5.816	76.133						
7	0.685	5.267	81.400						
8	0.569	4.378	85.778						
9	0.518	3.981	89.759						
10	0.434	3.335	93.094						
11	0.329	2.534	95.629						
12	0.301	2.318	97.947						
13	0.267	2.053	100.000						

Extraction Method: Principal Component Analysis.

Result of the Total Variance Explained

Table 2 above shows the result of the total variance. The result indicates that all the 13 question items extracted in the communalities can be decomposed to form five factor components as can be observed in the table below. The percentage cumulative variance of the rotation sums of the squared loadings of the five factor components is 70.312. This means that the 13 questions item on the questionnaire which has been condensed into 5 regression factor scores (standardised) can explain 70% of the variance in Cocoa production. Table 2 does not shows how the items are orthogonally distributed among the regression factors scores. To see how they are orthogonally distributed, we present the result of rotated component analysis in Table 3.

Table 3: Rotated Component Matrix

	Component				
	AOC	GOA	TERF	MTP	FERS
Q32	0.863				
Q30	0.857				
Q31	0.853				

Table 3...

Q34	0.785			
Q35	0.739			
Q33	0.665			
Q36	0.638			
V70		0.842		
V69		0.835		
Q38			0.873	
Q39			-0.871	
V72				0.851
V71				-0.814

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

The result of the rotated component matrix in table 3 shows that a number of questions on the questionnaires were to capture the following variables; access to credits (AOC), government policy assistance to cocoa farmers (GOA), perceived knowledge of temperature and rainfall as well as fertility (TERF) of the land. The use of chemical and sprays, marital status and number of dependency and the endogenous variable Cocoa production.

The result of the path regression analysis

Figure 1 below presents the result of the path analysis. This result was computed using AMOS data-fitting program (Arbuckle and Wothke, 1999). The rotation converged in 5 iterations to achieve model minimization. The interpretation of the path regression coefficients is the same as the interpretation of the multiple regression coefficients. Since the scores are standardised, they are interpreted in unit of standard deviation.

Figure 1 shows the hypothesized link between the determinants of cocoa production. The rectangle represents the observed variable, the one-sided arrow represent the path regression coefficient. The one-sided arrow move from the exogenous variables to the endogenous variable, showing the magnitude and direction with which the exogenous variables affect the endogenous variable, while the two-sided arrow shows the correlation between two exogenous variables. NGO and GOA are correlated because it is through non-governmental organisations (NGOs) such as farmers' cooperatives that cocoa farmers receive government assistance (GOA).

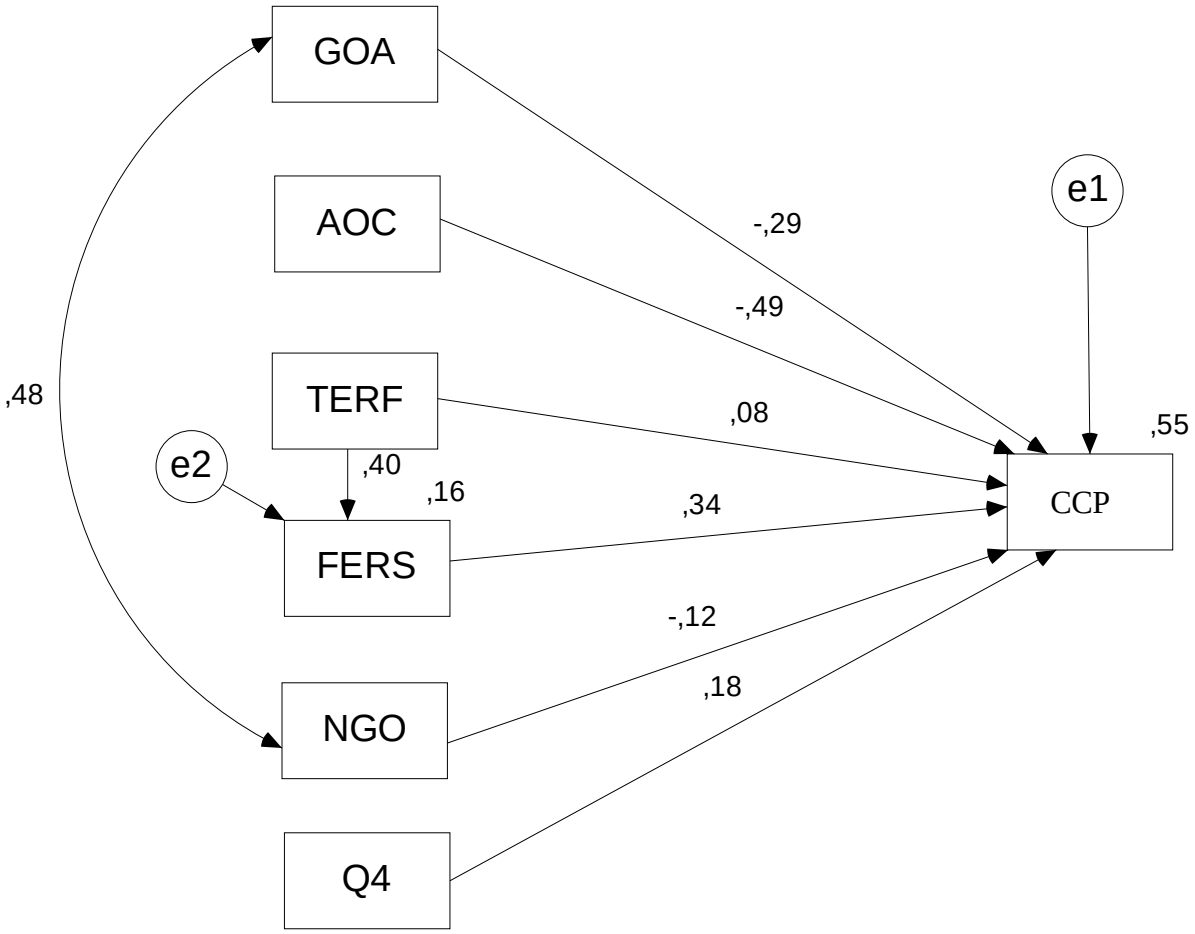

Figure 1: Path Regression

Figure 1 only shows the path regression weight or coefficients as well as the correlation coefficient. But this cannot tell whether the coefficients are significant or not. To know whether the path regression coefficients are significant, we present the summary of the findings in Table 4.

Table 4: Hypothesized Path Regression

Outcome		Determinants	Estimate	S.E.	C.R.	P	Decision
FERS	<---	TERF	-0.087	.058	-1.517	.129	Not Supported
Cocoa Production	<---	AOC	-0.344	.055	-6.248	***	Supported
Cocoa Production	<---	TERF	-0.194	.057	-3.423	***	Supported
Cocoa Production	<---	FERS	0.192	.055	3.490	***	Supported
Cocoa Production	<---	Marital Status	-0.076	.076	-1.001	.317	Not Supported
Cocoa Production	<---	GOA	-0.026	.075	-.340	.734	Not Supported
Cocoa Production	<---	NGO	-0.071	.067	1.053	.292	Not Supported

Note: *** indicate significance at 5 % significance level.

Table 4 shows that the probability of getting a critical ratio as large as 6.248, 3.423 and 3.490 in absolute value is less than 0.001. In other words, the regression weight for access to credits (AOC), perceived measure of climatic variability, temperature and rainfall (TERF) and the use of chemical and spray in the prediction of cocoa production are significantly different from zero at the 0.001 level (two-tailed).

Technically this can be interpreted to mean that access to credit (AOC) with the coefficient of -6.248 indicates that this exogenous variable has an inverse relationship with cocoa production. This implies that a unit increase in farmers' access to loans will reduces cocoa output by 6.248 tons showing that access to credit (AOC) has a negative significant impact on cocoa production. This is indeed contrary to appriori expectations and theory. Intuitively, increase access to credit is supposed to increase cocoa production (that is a direct and not and inverse relationship). This could be as a result of misuse of these loans by the farmers making it difficult for these loans to be paid back. Since their farms are the main source of collaterals, many farmers therefore end up losing their farms which impacts negatively on cocoa production. This result is in line with that of Kuntala and Samanta (2006), who attest to the fact that access to credit in rural India did not have any significant impact on physical assets accumulation and production because poor borrowers ended up in a viscous cycle of debts; as the poor use the money from the bank for consumption and were forced to borrow from money lenders in order to service bank loans. This is confirmed by Kondo et al (1992) who said borrowing without economic rationality and critical economic considerations or gains results into many poor people becoming more vulnerable and unable to services the credit, hence confiscation of their "assets" and or many end up in prison.

On the contrary Bemieh (2013) revealed that limited access to credit has been seen as a hindrance to production and productivity among cocoa farmers in the Nyong and Mfoumou Division of the Centre Region of Cameroon. Mukete et al (2016) and Lawal et al. (2015) equally attests to the fact that access to credit enhanced cocoa farming households' welfare.

Temperature and rainfall has a negative direct significant effect on cocoa production with a coefficient of -3.423. This implies that a unit increase of $1^{o}C$ in annual temperature and a 1mm increase in annual rainfall will lead to a 3.423 tons fall in total cocoa output. When temperature increases, its effects could be noticed through increase evaporation that reduces soil moisture, leaving the soil very dry for cocoa production. Although heat is needed for cocoa plant's growth, higher than normal temperatures shrink cocoa leaves leaving farmers with lower quality cocoa pots and reduction in output. Increase temperatures (especially through high sun intensity) also

form breeding grounds for capsids which causes “premature ripening” of the cocoa cherries (commonly called “sun ripe” by the cocoa farmers in the SWR).When rainfall increases above its required threshold for cocoa production it shrinks the growth and germination of cocoa cherries and induces pests and diseases affecting cocoa production. Increased rainfall form fertile environments for the proliferation of capsid and black pod diseases, which affects cocoa output. These conclusion is in line with the works of Ogunsola and Oyekale (2013); Kimengsi and Tosam, (2013) and Hutchins et al. (2015 who all testify of the negative effects of climate variability and change on cocoa production.

The use of fertilizers and chemical spray (FERS) has a coefficient of 3.490 indicating that this exogenous variable has a positive relationship with cocoa production. This implies that a unit increase in use of fertilizers and chemical spray (FERS) will increase cocoa output by 3.490 tons. This result agrees with that of Effah et al, (2017) whose investigation on the Determinants of cocoa production in the Ashanti region in Ghana identified mass spraying as one of the variables that insignificantly influenced cocoa production. Richman (2010) equally attest to the fact that fertilizer intensity has a positive and significant impact on technical efficiency and thus cocoa production. This is contrary to Teal et al., (2006) who indicated in their study that the number of times of mass spraying had negative impact on production (-11.52931) and was statistically significant at 0.031.

Both marital status, farmers’ involvement in NGO and GOA has no significant effects on cocoa production. The insignificant of the variables NGO and government assistant to farmers can be explain by the fact that the impact of this assistant is yet to be felt by the farmers or it has not yet reach a thresholds where it can have a significant effect on the activities of cocoa production. Forgha and Tosam (2013) re-iterated the fact that government assistance which they termed in their study as ‘political influence’ have no significant influence on cocoa output in Meme Division of the South West Region (SWR) of Cameroon. Kimengsiet al. (2016) in their study, attest to the fact that farmers sees involvement into NGOs as unprofitable, and thus the level of cocoa farmers organization into cooperatives is low with just approximately 20-30% of the farmers being involved in the SWR of Cameroon. On the contrary Lawal et al. (2015) using the ordered probit concludes that government assistance (GOA) on cocoa production positively affects the income and welfare of Cocoa Farming Households

Based on the above findings, supported by empirical evidences and theory the study concludes that both human as well as natural factors contribute significantly to Cocoa production in the South West Region of Cameroon.

CONCLUSION AND RECOMMENDATIONS

Determinants of cocoa production affect output differently. A factor that affects cocoa production positively in the Southern Region in Cameroon may affect production negatively in Ondo State in Nigeria and a factor that affected cocoa production positively Ondo State in 1968 may affect it negatively in 2018. Therefore the factors affecting cocoa production differ between time and area; thus the factors affecting cocoa production in every cocoa producing area need to be identified so as to look for means through such factors could be improved on for better production. This study reveals that fertilizer usage and chemical spray has a positive significant effect on cocoa production in the South West Region with climate and access to credit having a negative significant effect on cocoa production.

The study therefore recommends as follows: Credit lending institutions need to further penetrate and reach out even to the poorest of the poor in cocoa growing communities, because micro-credit is a leeway for the poor to exit poverty. Rather than providing loans to farmers that are misused and they end up not paying back, it would be better for the banks to embark on the provision of agricultural loans. This could be in the form of inputs (cutlasses, sprayers, fungicides, pesticides and fertilizers among others). Again most banks see most cocoa farmers as high risk clients which make it difficult for them to obtain loans. We therefore recommend the amalgamation of various “Njangi groups” in the communities to form a micro-financial unit otherwise known as village banks that will make loans available to farmers, as their cocoa farms can serve as collateral security and they can better monitor the borrower to see that the loan is used for the purpose for which it was contracted.

The government should embark on research in the cocoa sector so that improved cocoa species which are more adaptive under the current and highly unpredictable climate scenario can be introduced. The Institute of Agricultural Research for Development (IRAD) should be provided with the necessary funding and other material resources to enable them undertake this research Also, as a way of reducing losses from cocoa pests and diseases, new breeds which have been tested and approved to be disease resistant should be made available to farmer.

The farmers should resort to inter-planting Trap and Decoy Crops: Trap cropping is the planting of a trap crop to protect the cocoa crop from fungicides and pesticides. While decoy crops are non-host crops that are planted to make nematodes (pest and diseases) waste their infection potential.

The government of Cameroon should ensure that fungicides (ridomil, calomil, nordox, among others) for fighting cocoa black pod disease and other pesticides of high potency are made available to farmers at affordable prices. Adequate arrangements for distributing the product to farmers at regulated prices should be made to facilitate access and timely spraying of

cocoa pods. The government should embark in checking and getting rid ofthe too many cocoa chemicals that have flooded the markets some of which are not effective in combating cocoa pest and diseases, thus confusing the farmers.

The government should change her strategy in the way subventions are provided to cocoa farmers. An independent monitoring commission (not attached to any arm of the government) should be formed that will be charged with the duty of seeing that subventions from the state are not intercepted by anyone along the chain but get to farmers at the grass roots. The farmers on their part should enlist themselves in common initiative groups and cooperatives (NGOs) so as to make it easy for the government to reach them. These NGOs should not be headed or controlled by those elites who live in towns and have the tendency of easily intercepting these subventions but by the indigenous farmers.

The farmers should get involve in Production Insurance Schemes, which will compensates cocoa farmers for lower yield due to adverse climatic effects, wildlife, pest infestation or disease and other disasters as well as significant drops in their prices.

SCOPE FOR FURTHER RESEARCH

This study covers only one of the seven cocoa producing regions in Cameroon. There is a need for a study that will be more representative, covering the entire cocoa producing regions in Cameroon. This will give a much clearer picture of the factors effecting cocoa production in Cameroon for better recommendations.

In addition, this study looks at cocoa production only from the point of production on the farm to when the cocoa is sold at the farm gate (that is to licensed buying agents LBA). It should be noted that there are other factors beyond the farm gate that could affect cocoa production. Therefore there is need for a study that will cover the entire cocoa value chain (that is from production on the farm to when it is processed and marketed).

REFERENCES

Abekoe, M.K.,Obeng-OforiD. AndEgyir I. S., (2002).Technography of Cocoa in the Forest Zone of Ghana. Report presented at the 'Convergence of Sciences' International Workshop, 23–29 March 2002, Benin. Unpublished project document, 29.

Aneani, F., Anchirinah, V. M., Owusu-Ansah, F. and Asamoah, M. (2011) An Analysis of the Extent and Determinants of Crop Diversification by Cocoa (Theobroma cacao) Farmers in Ghana, African Journal of Agricultural Research, Vol. 6(18), pp. 4277-4287,

Armathé, A. J., Mesmin, T., Unusa, H., and Soleil, B. R. A. (2013). A comparative study of the influence of climatic elements on cocoa production in two agro-systems of bimodal rainfall: Case of Ngomedzap forest zone and the contact area of forest-savanna of Bokito. Journal of the Cameroon Academy of Sciences, 11(1).

Bemieh C. F. (2013). Small-scale versus large-scale cocoa farming in Cameroon: which farm type is more ready for the future? Advanced level European Erasmus Mundus Master Program: Agricultural Food and Environmental Policy Analysis (AFEPA) Degree thesis No 829, ISSN 1401-4084

Chambon, B. &Mokoko, G. S. (2013) Les déterminants du choix des cultures pérennes dans les systèmes de production diversifiés des hévéaculteurs au sud-ouest Cameroun. In Cultures pérennes tropicales: enjeux économiques et écologiques de la diversification. (pp.185-196). Versailles Cedex, France: Éditions Quae.

Drum Commodities (2012) "An Introduction to the Cameroon Cocoa Industry" [online] Availablefromhttp://www.drumcommodities.com/sites/default/files/May%202012 Cameroon % 20 Cocoa%20 Industry_0.pdf.

Effah E. S, Yusif H. M. and Kwasi W. B, (2017) Determinants of cocoa production in the Ashanti region International Standard Journal Number (ISJN) e-ISJN: A4372 – 2604 ISSN 2354 – 4147 VOL. 5 (1), PP. 21-25,

Fadipe A. E. Adenuga A. H. and Ilori, T.E (2012) Economic Analysis of Cocoa Production in Oyo State, Nigeria. Nigerian Journal of Agriculture, Food and Environment; NJAFEVOL. 8 No. 4, 58-63.

FAO, (2014).The state of agricultural commodity markets, FAO, Commodities and Trade Division, Rome.

Forgha N. G. and Tosam J. N. (2013) An Analysis of the Socio-Economic Determinants of Cocoa Production in Meme Division, Cameroon. Greener Journal of Business and Management Studies ISSN: 2276-7827 Vol. 3 (6), pp. 298-308,

Fule, B (2013). Small-scale versus large-scale cocoa farming in Cameroon. Which farm type is more ready for the future? Master of Science Thesis in Agricultural Food and Environmental Policy Analysis (AFEPA).Swedish University of Agricultural Sciences, Uppsala. Available at http://stud.epsilon.slu.se/6438/1/Fule_CB_140218.pdf.Accessed 20th May, 2016.

Gayi S. K. and Tsowou K. (2015) Cocoa industry: Integrating small farmers into the global value chain; Special Unit on Commodities, UNCTA New York and Geneva, 2016

Gockowski, J.J. &Dury, S. (1999). The economics of cacao-fruit agroforests in southern Cameroon. Retrieved March 20, 2014 from http://orton.catie.ac.cr/ repdoc/A1599i/A1599i.pdf

ICCO (2001), International Cocoa and Coffee Organisation, Quarterly Bulletin of Cocoa Statistics, Washington DC, (Vol. XXII, No.2, Cocoa year2000/01)

ICCO (2012), International Cocoa and Coffee Organisation, Countries' shares in cocoa production (own version with data from ICCO Quarterly Bulletin of Cocoa Statistics, Vol. XXXVIII, No.3, Cocoa year 2011/12

Iyabano, A. H. (2012). Analyse du fonctionnement de la filière cacao (Theobroma cacao L.): Une estimation des coûts et marges des acteurs (cas des regions du sud et sud ouest, Cameroun). Mémoire de fin d'études présenté en vue de l'obtention du Diplôme d'Ingénieur Agronome.The University of Dschang.

Kimengsi J. N. and Tosam J. N. (2013) Climate Variability and Cocoa Production in Meme Division of Cameroon: Agricultural Development Policy options. Greener Journal of Agricultural Sciences ISSN: 2276-7770 Vol. 3 (8), pp. 606-617

Klarer A. J. (2014) The Evolution and Expansion of Cacao Farming in South West Cameroon and its Effects on Local Livelihoods; Resources, Agricultural Systems and Development (RESAD) Published Master Thesis, Copenhagen University, Copenhagen AFS4Food, SupAgro IRC, Montpellier

Kyei L., Foli G. and Ankoh J. (2011) Analysis of factors affecting the technical efficiency of cocoa farmers in the Offinso district -Ashanti region, Ghana; American Journal of Social and Management Sciences ISSN Print: 2156-1540, ISSN Online: 2151-1559, doi:10.5251/ajsms., http://www.scihub.org/AJSMS

Kondo, Tosho. Orbeta, Aniceto. Dingcong, Jr. Clarence and Infantado, Christine. (1992): "Impact of Microfinance in Rural Households in the Phillipines." Edited by Carabinie Deirdre and O"Relly Martin, Paper presented in the International Conference held at Uganda Martyr"s University, Nkozi. Kampala UMU press

Kuntala, Lahiri-Dutt and Samanta, Gopa.(2006). "Constructing Social Capital: Self Help Groups and Rural Women"s Development in India."Journal Compilation, Institute of Autralian Geographers.

MINADER, (2013).Annual Report 2012 for the South West. Ministry of Agriculture and Rural Development for Cameroon. Report Retrieved from the Regional Delegation, 2013.

MINADER Meme. (2017). Annual Report for the Ministry of Agriculture and Rural Development, South West Region, Meme Divisional Delegate, 2017.

MINADER, (2018).Annual Report 2018 for the South West. Ministry of Agriculture and Rural Development for Cameroon. Report Retrieved from the Regional Delegation, 2018.

Mubeteneh C. T (2015) The Cameroon Cocoa Story; report produced with the assistance of the European Union within the project "Supply Change – Make Supermarkets fair", Department of Crop Science, University of Dschang, Cameroon

Mukete, N. (2016) Analysis of the Technical Efficiency of Smallholder Cocoa Farmers in South West Cameroon. American Journal of Rural Development. Vol. 4, No. 6, 2016, pp 129-133.

NCCB (2014).(National Cocoa and Coffee Board).Cocoa Statistics. Retrieved from www. oncc.com

Ojonimi A. O., Deedam N. J. and Ifeyinwa A. A. (2012) Profitability and Yield Determinants In Nigerian Cocoa Farms: Evidence from Ondo State; Journal of Sustainable Development in Africa (Volume 14, No.4, 2012) ISSN: 1520-5509

Oyekale A.S. and Oladele O.I. (2012) Determinants of Climate Change Adaptation Among Cocoa Farmers in Southwest Nigeria, Journal of Science and Technology, ICESR 2012 ISSN 2225-7217 ARPN, VOL. 2, Special Issue.

Oyinbo O. and Olaleye K. T (2016) Farm Households Livelihood Diversification and Poverty Alleviation inGiwa Local Government Area of Kaduna State, Nigeria. The Journal of Sustainable Development Vol. 15, Iss. 1, Pp. 219-232

Richman D. (2010). What Drives Efficiency on the Ghanaian Cocoa Farm? Ghana Institute of Management and Public Administration.www.csae.ox.ac.uk/conferences /2010-EDiA/papers/498-Dzene.pdf

Teal, F., Zeitlin, A. and Maamah, H. (2006) Ghana Cocoa Farmers Survey 2004: Report to Ghana Cocoa Board. Centre for the Study of African Economies, Oxford University (http://www.gprg.org/pubs/reports/ pdfs/2006-04-teal-zeitlin-maamah.pdf).

Tchokote J., Onyebuchi K. O., Paul M., Nguezet P. M. D., (2015): An Economic Appraisal of Cocoa Production in Cameroon: The Case Study of Lekie Division. Journal of Economics and Sustainable Development, Vol.6, No.9,

Uba, A.A. (1998). Processing cocoa for export: A business times Lagos Publication.

UNCTAD (2004) United Nations Conference on Trade and Development, 2004. Handbook of International Trade and Development Statistics.Geneva Switzerland.

UNEP, (2013).United Nations Environmental Programme (UNEP) (2000).Integrating Adaptation to Climate Change into UNEP Programming. Nairobi, Kenya 8-9 April 2000 UNEP Sourcebook

Wandji N. D; Nkeh L. J; Jim J. G. and Tchouamo I. (2006) Socio-economic impact of a cocoa integrated crop and pest management diffusion knowledge through a farmer field school approach in southern Cameroon. Contributed Poster prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12-18, 2006

WCE, (2012).World Cocoa Economy; Annual Report, Washington DC

WCE, (2014).World Cocoa Economy; Annual Report, Washington DC