



Livelihood Diversification and Cocoa Farmers' Wellbeing in Rural Cameroon; an Empirical Analysis

Joseph Tosam Ngong^{a*} and Jude Ndzifon Kimengsi^{b,c}

^a Department of Public Economics, University of Maroua, Cameroon.

^b Faculty of Environmental Science, Forest Institutions and International Development (FIID) Research Group, Technische Universität Dresden, Germany.

^c Department of Geography, University of Bamenda, Cameroon.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JEAI/2022/v44i1030872

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/89409>

Original Research Article

Received 15 May 2022
Accepted 20 July 2022
Published 23 July 2022

ABSTRACT

Cocoa farming is a key livelihood strategy for farmers in rural Cameroon, as studies have significantly revealed its contribution to the wellbeing of rural dwellers. Yet, the wellbeing outcomes of livelihood diversification for cocoa remains relatively less understood. This study analyzes the effects of livelihood diversification on the wellbeing of cocoa farmers in rural Cameroon using household data (N = 430) from six cocoa producing divisions in the South West Region. With the use of the Path Regression and the Principal Component Analysis (PCA), the study identified; access to credit, government assistance, temperature and rainfall, the use of chemical spray and fertilizers, and support from Non-Governmental Organisations (NGO) as welfare determinants. Climate variability (temperature and rainfall) has a significant negative effect on cocoa production, while the use of fertilizers and chemical spray has a positive effect on cocoa production and thus household income (welfare). The study revealed that diversification has a positive effect on cocoa production and a negative effect on household income. The study therefore recommends the initiation of a policy that will enable the establishment of a "risk management scheme" (insurance scheme) for cocoa farmers which would include the following: *Production Insurance*, which compensates cocoa farmers for lower yield due to adverse climate, wildlife, pest infestation or disease and other disasters; *Agristability*, which will compensate cocoa farmers for significant drops in their prices and farm income.

*Corresponding author: E-mail: jtosam@yahoo.co.uk;

Keywords: Livelihood diversification; well-being; Cameroon; determinants; cocoa farmers.

1. INTRODUCTION

If the battle to achieve the universal society's stated objectives on hunger and poverty reduction will be won or lost, then it will be in the rural areas of the developing countries [1]. Of the world's 1.2 billion extremely poor people, 75 percent live in rural areas, with most of them depending on agriculture for their well-being [1,2]. Approximately 43% of the population in Cameroon live in rural areas with a majority living in poverty and deprivation [3-5] (O'Neil, 2022;). In 2007, the rate of poverty in rural areas in Cameroon was at 55% as compared to 12.2% for urban areas. As of 2014 the rate of rural poverty stood at 56.8% as compared to 8.9% for urban areas [6,7]. The Multidimensional poverty Index (MPI) country briefing in 2021 [8], attest to the fact that the incidence of poverty in rural areas in Cameroon stands at 71.1% as compare to 16.0% in urban areas; while average intensity of poverty stands at 54.7% for rural areas as compare to 46.7% for urban areas.

About 90% of the rural population in Cameroon is estimated to be engaged in agriculture especially small-scale agriculture including cocoa production [9]. The agricultural sector is a foundation of livelihoods for an estimated 70 percent of the country's population and the main source of job provision for smallholders as well as "farm-finance social welfare" when there are urban shocks. This makes it a vital instrument for poverty reduction and economic development [10-13]. Since almost all rural households depend directly or indirectly on agriculture, agriculture is therefore a major contributor to household income and wellbeing [3,14,15]. The strength of the agricultural sector in Cameroon comes principally from the export crop sector with cocoa as the leading subsector.

"Cocoa plays a vital role in Cameroon's economic development and remains an important source of income, with about 60 percent of the country's population depending directly or indirectly on it for their livelihood" (FAO, 2005) [16]. Cameroon earns about 250 billion CFA francs a year from cocoa, accounting for about half its primary-sector exports [17,18]. "National income from cocoa exports was the highest among all agricultural products in Cameroon as of 2011" [19]. The cultivation of this important crop which is a major contributor to export earnings, employment and Gross

Domestic Product (GDP), of the country is predominantly in the rural areas; with the country's two main producing basins found in the South West and Centre Regions respectively. The South West basin produces over 58% of the country's total production. Despite the important role played by the cocoa sector in Cameroon, the sector is still facing some challenges that are threatening its existence. some of these challenges include; low productivity, declining soil fertility, high costs of farm inputs, outdated production systems and poor farm management practices, inadequate extension and advisory services, farms accessibility, marketing problems, access to credit, among others, which affect production, the income realized and thus welfare [20,21].

Cocoa farmers are challenged by the increased risk of crop failure, price fluctuations, among others [22]. "It is therefore becoming inevitably clear that the cocoa production alone cannot be relied upon as a livelihood strategy. Livelihoods are the ways through which people satisfy their needs, or gain a living" [23] (Chambers and Conway 1992). A livelihood should be sufficient to avoid poverty, and preferably, increase well-being for a typical worker plus dependents. Diversification has been defined by Kimenju and Tschirley [24] as 'the number of economic activities an economic unit is involved in and the dispersion of those activities' shares in the total economic activity of the unit. According to Stifel, [25], single livelihood sources have proven over the years to be insufficient to emancipate the rural poor from their poverty trap, requiring the adoption of multiple options. Consequently, the reliance of rural households on off-farm and non-farm activities has become an important component of livelihood strategies among rural households. Livelihood diversification therefore supports farm households to accumulate income for farm expansion, engagement in non-farm businesses and to solve immediate household needs such as food, shelter, health care, payment of school fees among others [26,27].

In this study, livelihood diversification denotes all efforts by cocoa farmers to find new ways through which income can be raised for welfare improvement as well as to reduce environmental risk. Thus, livelihood diversification includes both on- and off-farm activities which are undertaken by cocoa farmers to generate income additional to that from cocoa farming. The increasing

incidence of low level of welfare among rural households in Cameroon, that remains unabated despite various policy reforms undertaken by the government, requires a deeper understanding of the problem and the need to proffer solutions to the problem through approaches that place priority on the poor and ways on which rural households through diversification can improve on their well-being. Even though some extensive literature already exists on the impacts of livelihood diversification, the evidence is somewhat mixed and ambiguous [25,28] (Bezabiw et al., 2010). In Cameroon, very little have been done in the domain of cocoa production and diversification. This study is again necessary due to the fact that some scholars have erroneously established the effect of cocoa production on welfare without filtering out the effect of diversification. Thus an investigation to ascertain the effect of livelihood diversification on the welfare of the cocoa farmers in rural Cameroon is imperative. To achieve this, the following objectives have been established: (1) identify the determinants of cocoa production as well as welfare determinants among the cocoa farmers in rural Cameroon, and (2) examine the effect of livelihood diversification on cocoa farmers' welfare in rural Cameroon.

2. MATERIALS AND METHODS

2.1 Study Area

This study is carried out in Cameroon, attention is given to the rural areas of the country where

cocoa is predominantly produced. Specifically, the study focuses on the South West Region (SWR) of the country which produces over 58% of the country's total cocoa output [4,19]. The region is heavily endowed with a lot of potentials for cocoa production [29,30]. This Region has a surface area of 25,410 km². It 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 Littoral region. The SWR is partitioned into six administrative governing units, with each known as a division. These six divisions are; Fako, Kupe Muanenguba, Lebalem, Meme, Ndian, and Manyu. Cocoa production takes place in all the above divisions but not of the same magnitude. This study therefore, covers all the cocoa producing areas of the six divisions of the SWR. Regarding poverty, according to 2014 ECAM4, 18.2% of the households in the region live below the poverty line. Below is the map of Cameroon showing the SWR and the map of the SWR showing all the cocoa producing areas.

2.2 Data Collection

The study made use of primary sources of data. Primary data was obtained with the use of 430 structured questionnaires. The study equally made use of a multi-stage sampling technique with a three-stage sampling frame. In the first stage, a stratified sampling technique was employed in which the six divisions that make the South West Region (SWR) were carved out, with each division taken as a stratum.

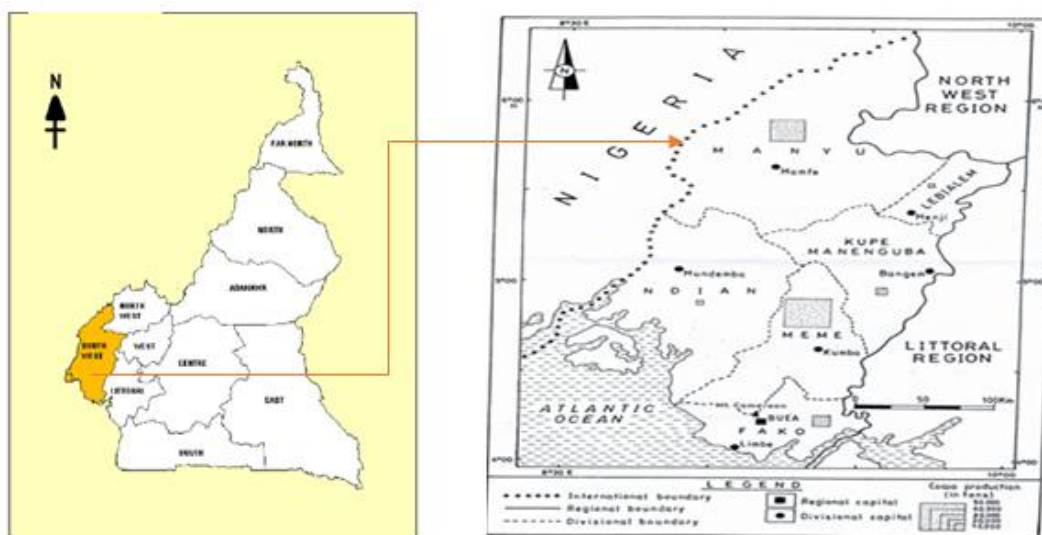


Fig. 1. Map of south west region showing the cocoa producing areas

Source: Adapted from the Department of Survey South West Region

The names and precise location of all the cocoa producing villages/communities in the region was obtained from the divisional and regional delegations of agriculture in the South West Region. 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 stratum. In the third stage convenient sampling technique was adopted, in which the villages/communities to be sampled were chosen depending on the ease with which one could reach the said village due to the socio political crisis in the study area and households to be sampled were randomly chosen from each of the selected villages.

2.3 Empirical Model

Given the objective of this study, two models are appropriate for our analysis; model one paves a way for the analysis of the determinants of (welfare) cocoa production among cocoa producers, while the second model enabled us to analyse the relationship between livelihood diversification and cocoa farmers' welfare in rural Cameroon. The Principal Component analysis (PCA) PCA and path regression was found to be relevant in the analysis of these two models. Path analysis is the extension of multiple regressions. 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.

Model one: All other things being equal, all factors determining cocoa production will determine household income and thus welfare. As a result, all determinants of cocoa production in this study are considered as welfare determinants.

The Barnum-Squire farm household model form the theoretical foundation for the analysis in model one. This provides a framework for generating predictions on how farm households respond to changes in domestic and market variables among others.

The production function in this model looks at farm output which can be traded, and not just as for home consumption, and how this transaction affects the farm household well-being. The

Barnum-Squire Farm Household Model is given as;

$$Y = f(A, L, V) \tag{1}$$

From the equation (1) above, *A* is land under cultivation, *L* is the total labour input (both household and hired) and *V* is other variable inputs used in production and *Y* the output.

This model is very vital in this study given that cocoa production in the SWR and Cameroon in general is mainly for sale. Thus, the study adopted an augmented The Barnum-Squire Farm Household Model, in which some of the variables in the origin The Barnum-Squire Farm Household Model that were not deemed necessary in this study were dropped while those deemed vital that were not in the original model were added. The model is presented thus;

$$HHI = f(HHS, COP, FAS, EHH, GOA, AOF, AOC, TERF, SOF, FERS, NGO, MS) \tag{2}$$

Where (HHS) = household size, (COP) = price, (FAS) = farm size, (EHH) = education of household head, (GOA) = government assistance, (AOF) = age of farmer, (AOC) = access to credit, (TERF) = temperature and rainfall, (SOF) = soil fertility, (FERS) = chemical spray and fertilizer, (NGO) = farmer organizations, (MS) = marital status and (HHI) = the construct house income.

A pre-test analysis known as Principal Component analysis (PCA) was conducted. From this pre-test analysis, all the variables retained for further statistical investigation are those that can at least explained more than 50% of the variance in the regression factor scores. This reduction analysis helps in improving impact of the independent (exogenous) variables on the dependent (endogenous) variable. This is therefore the reason why some of the observed (independent) variables in equation (2) will no longer appear in our econometric model below.

Econometric model:

$$CCP_t = \Omega_0 + \Omega_1 GOA_i + \Omega_2 AOC_i + \Omega_3 TERF_i + \Omega_4 FERS_i + \Omega_5 NGO_i + \Omega_6 MS + \varepsilon_t \tag{3}$$

Where Ω_0 = constant term, $\Omega_1, \Omega_2, \Omega_3, \dots, \Omega_6$ are coefficients of the variables and the subscript *i* indicates the observations across individuals, *t* is the time period and ε is the error term.

Model two: Model two establishes the relationship between livelihood diversification and the farmers' welfare. The theoretical foundation of this model is the Chayanov Farm Household Model. This model assumes that the household maximise utility (welfare) subject to its production function and total time constraint. See the Chayanov Farm Household Model below:

$$U=F(YH) \tag{4}$$

Where U = utility (welfare), Y = production and H = time constraint for other activities

This study has contextualised this model and has come up with an econometric model that examines how the cocoa farmer maximizes utility (welfare) by producing cocoa and carrying out other activities (diversification in this case). Focus in this study is on how the carrying out of these other activities (diversification) affects utility (welfare). This has been captured by both direct and indirect empirical econometric models as seen below.

Direct empirical model:

$$HHI_i = \beta_0 + \beta_1 CCP_i + \beta_2 LHD_i + \epsilon_i \tag{5}$$

The direct specification shows the relationship between livelihood diversification and household income (welfare).

Where LHD = livelihood diversification, HHI = household income and CCP = cocoa production,

Where; β_0 is the constant term (intercept) and β_1 and β_2 are the parameters to be estimated using partial least square estimation techniques of structural equation modeling. Where the subscript i indicates that the observations across individual parameters at a particular time.

Indirect empirical model:

$$HHI_i = \beta_0 + \beta_1 \beta_3 CCP_i \cdot LHD_i + \epsilon_i \tag{6}$$

The functional form of the model shows the indirect relationship between livelihood

diversification and households' income mediated by cocoa production.

Where; the coefficient of parameter β_1, β_3 is estimated using the partial least square algorithm of SmartPLS software. This study made use of household income (HHI) as a proxy for welfare. However, it is evident that most of the studies that have used income as a measure of welfare have often resulted to the use of per capita household income, which however have its short comings because income in itself except put to use cannot determine welfare. This study takes household income as a proxy for welfare and moves further to examine how this household income is used in the provision of basic needs for the household, child education and home consumption among others (that is the uses of household income).

3. RESULTS

3.1 Welfare Determinants among Cocoa Farmers in the South West Region

As mentioned earlier, this study made use of the path regression in its data analysis. To run path regression analysis, there are some preliminary analyses that are indispensable. The preliminary analysis here is the principle component analysis.

The forgoing table 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 ($p = 0.000$) of Bartlett's test, is below 0.05, which indicates that it is significant at the 99% confidence level. Thus, the correlations structure is significantly strong enough for performing a factor analysis on the items. The principle component analysis permits 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 22.

Table 1. KMO and Bartlett's test

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

Source: Computed by the Author using SPSS 21, 2018

This procedure maximise the validity of the estimates. 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.

3.1.1 The result of the path regression analyses

The result was computed using AMOS data-fitting program (Arbuckle and Wothke, 1999). 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. The path regression results show the coefficients as well as the correlation between the endogenous and exogenous variables and they equally indicate whether the coefficients are significant or not. The Table 2 presents a summary of the findings.

The above result shows that the probability of getting a critical ratio of 6.248, 3.423 and 3.490 in absolute value is less than 0.001. This implies that climate variability, that is, temperature and rainfall (TERF) and the use of Fertilizers and chemical spray (FERS) and Access to Credits (AOC), affect cocoa production significantly. This can be interpreted to mean that access to credit and perceived temperature and rainfall has a negative direct significant effect on cocoa production whereas the use of chemical to spray the farm (spray and fertilizers) has a positive significant effect on cocoa production. The

indirect effect of temperature and rainfall on cocoa production, mediated with the variable chemical spray and fertilizer usage in on cocoa farms is insignificant. Both marital status, farmers’ involvement in Non-Governmental Organizations (NGO) and Government Assistance (GOA) has insignificant effects on cocoa production.

From the above findings; access to credit (AOC), temperature and rainfall (TERF), the use of chemical spray and fertilizer (FERS), Non-Governmental organizations (NGO) and marital status (MS) have been identified as cocoa production determinants. Since all factors affecting cocoa output equally affects household income (welfare), these determinants are considered in this study as welfare determinants among the cocoa farmers in the SWR of Cameroon. “To determine the extent to which livelihood diversification affects household income (welfare) of the farmers in the SWR of Cameroon”, a pre -test analysis was conducted. This is done to ensure that the items reflect the concepts being measured. In other words, pre-test was necessary to ensure reliability and validity of the concepts being measured.

3.2 Livelihood Diversification and Cocoa Farmers’ Welfare in the South West Region

The Table 3 shows the test of factorability of the items of livelihood diversification measure through dimensional reduction Techniques.

Table 2. Path regression results

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 significant at 5 % significant level.
Source: Computed using Amos 16 by the Author, 2018

Table 3. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.644
Bartlett's Test of Sphericity	Approx. Chi-Square
	df
	Sig.
	786.460
	66
	0.000

Source: Computed by the researcher using SPSS 21, 2018

The results on the above table revealed that Bartlett's test for sphericity and the Kaiser-Meyer-Olkin (KMO) are significant. The significance of this test supports the factorability of the items of livelihood diversification. The importance of the pre-test, to factor analysis and principal component cannot be over emphasized. The study proceeds to present the result of the communalities which indicate the proportion or share variance explained by each item in the construct of the variable livelihood diversification. The share variance explained by each item in the construct of the variable livelihood diversification shows that the questionnaire items under livelihood diversification is reduced to 3 main regression factor scores through varimax rotation extraction method of principal components analysis with a percentage cumulative variance of 64.93%. The three regression factor scores are ACI, IGA and QAS; Where ACI is Accessibility to Input Factors, IGA is Alternative income Generating Activities and (QAS) is Quick Alternative income Source.

Correlation measure the degree of association between the constructs or variables in a study. According to Cohen (1988), correlation

coefficient of positive or negative one (+1 or -1) is described as weak; correlation coefficient of positive or negative three (+3 or -3) is described moderate and positive or negative five (+5 or -5) is described as strong correlation. From the analysis above, there is a strong relationship between livelihood diversification and Cocoa production ($r = 0.514$). There is a moderate relationship between livelihood diversification (LHD) and household income (HHI) ($r = 0.377$). This strong relationship between livelihood diversification (LHD) and Cocoa production (CCP) is in line with the recommended cut-off criteria suggested by Brace et al., (2006).

The Fig. 2 Structural Equation Model shows the relationship between the inner models constructs as well as the relationships between the observed variables (or indicators) and the constructs. Circle in light blue represents the constructs while the rectangles in yellow represents the observed or manifest variables used in the construction of the model [31]. The circles represent the constructs, and the values inside the circles are the estimates of the squared multiple correlations (R^2) for each

Table 4. Latent variable correlations

	CCP	HHI	LHD
CCP	1		
HHI	0.609	1	
LHD	0.514	0.377	1

Source: Computed by the researcher using SPSS version 21, 2018

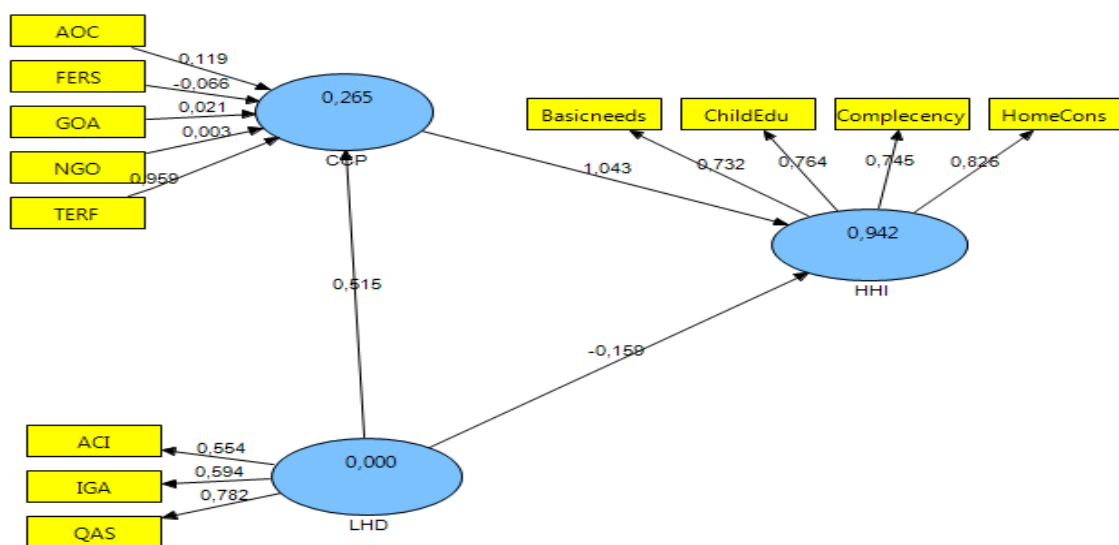


Fig. 2. Structural Equation Model of livelihood diversification and household

Source: Researcher's computation, 2018

Table 5. Path coefficients (Mean, STDEV, T-Values)

Hypothesized link	Coefficient	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics	Decision
LHD -> CCP	0.533677	0.046230	0.046230	11.133152	Supported
LHD -> HHI	-0.165471	0.037320	0.037320	4.263297	Supported

Source: Researcher's computation, 2018

dependent construct in the model. All the circles have estimates of the squared multiple correlations (R^2) except for livelihood diversification, since it is a cofounding exogenous variable. The used of construct can be justified on the bases of the fact that livelihood diversification, households' income and cocoa production are multifaceted concepts. As such it will be erroneous if a single observed variable is used as a proxy for these concepts. We have both the inner and outer model on the above figure. The inner model is also called structural model. It shows the relationship among the constructs. There are only two types of outer models in this study, 'reflexive and formative' measurement models. For reflexive measurement models the arrow move from the construct to the manifest or observed variables while for formative the arrow move from the observed to the construct. The question items used as manifest of the constructs were valid and reliable. The factor loading for the entire construct was well above the cut-off criteria of 0.5 as suggested by Thalut, [31]. However, the significance of the relationship between the constructs in the inner model as well as the relationship between the observed variables and constructs can be assessed by looking at the path analysis results as presented on the Table 5.

Livelihood diversification has a negative coefficient of - 0.16547. This implies that Livelihood diversification among the cocoa farmers has a negative significant effect on household income. Nevertheless, livelihood diversification has a positive coefficient of 0.533677. This denotes that livelihood diversification has a positive significant effect on cocoa production. Therefore, livelihood diversification has an indirect positive effect on household income through its effect on cocoa production.

4. DISCUSSION

A number of determinants of cocoa production, which in this study are considered as welfare

determinants such as for access to credits (AOC), perceived measure of climatic variability, [temperature and rainfall (TERF)] and the use of fertilizer and chemical spray (FERS) significantly affect cocoa production. Access to credit (AOC) has a coefficient of -6.248, which implies that a unit increase in farmers' access to loans will reduce cocoa output by 6.248 tons, thus, indicating that AOC has a negative significant impact on cocoa production. This is indeed contradictory to both theory and practice. In every sense access to credit is supposed to have a direct and not and inverse relationship with cocoa production. The implications of this result could be the fact that credits to farmers in the South West region are characterized by information asymmetry which leads to adverse selection and of course moral hazards. Banks turn to rely on the information given by the borrowers (information asymmetry), this at times causes them in exclude those that are capable of paying back loans obtained and grant loans to those who may not repay the loans (adverse selection). In most cases the banks cannot monitor the borrower after the loan has been granted and as such many farmers divert loans that are meant for production to consumption and other activities (moral hazard) 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 their output and of course welfare. The above result is in line with the study of Kuntala and Samanta [32], "who confirm to the fact that access to credit in rural India did not have any significant impact because poor borrowers ended up in a viscous cycle of debts". Similarly, Kondo et al. [33] attested to "the fact that borrowing without economic rationality 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". This results are contrary to the studies of Navajas et al. [34]; Kabber (2001; Adams and Paje [35]; Okurut et al. [36]; Yunus [37]; Anyanwu [38] and Chigozie [39]; Bellemare, et al. [40]; Mukete et al [41]; Biyase and Zwane [42], who revealed that access to credit or micro

credit provision has significant positive impact on output, household income, poverty alleviation and welfare.

The coefficient of Temperature and rainfall (climate variability) is -3.423, thus, Temperature and rainfall has a negative significant effect on cocoa production. This result implies that a unit increase of 1°C in annual temperature and a 1mm increase in annual rainfall above the threshold required for cocoa growth will lead to a 3.423 tons fall in total cocoa output. This result is in line with the works of Ojo and Sadiq [43]; Ogunsola and Oyekale (2013); Kimengsi and Tosam, [44] and Hutchins et al. (2015 who attested of the fact that temperature and rainfall beyond the normal threshold for the cocoa production negatively affects cocoa output. The coefficient of 3.490 for fertilizers and chemical spray (FERS) indicates that this variable has a positive significant effect on cocoa production. This result is similar to that of Richman [45] and Effah et al, [46] who attested to the positive effect of mass spraying and fertilizer application on cocoa production. This is however contrary to the study of Teal et al., [47] who revealed "in their study that the number of times of mass spraying had a negative significant impact on cocoa production".

The insignificance of the variables NGO and GOA to farmers can be explained by the fact that, the assistance from the government, through Non-Governmental organisations in most occasions do not get to the farmers, thus, the impact of this assistance is yet to be felt by the farmers or it has not yet reached a threshold where it can have a significant effect on the activities of cocoa production. From our analysis of the measure of the effect size, it has been revealed that there is a strong relationship between livelihood diversification and Cocoa production ($r = 0.514$). This analysis also shows that there is a moderate relationship between livelihood diversification and household income ($r = 0.377$). Our path regression analysis indicates that livelihood diversification has a negative significant effect on household income, implying that livelihood diversification among the cocoa farmers contributes negatively to the level of household income. By implication an increase in diversification would lead to a decrease in household income. This is indeed contradictory to a priori expectation. Intuitively, diversification is expected to increase household income (that is a direct and not an inverse relationship). The justification of this result perhaps could be as a

result of the fact that cocoa production has been ranked 1st among other income generating activities on the global markets [48]. This is in line with the work of FAO, [19] which attested to the fact that, national income from cocoa exports was the highest among all agricultural products as of 2011 in Cameroon. Thus all other things being equal when labour is diverted from the production of cocoa to other activities, less is realized than when the entire household labour could have concentrated in production of cocoa in the South West Region (SWR). This therefore impacts negatively on the income of the household. However, livelihood diversification has a positive significant effect on cocoa production. This entails that an increase in livelihood diversification would lead to an increase in cocoa production. The outcome of livelihood diversification on cocoa production is justified by its influence on accessibility to input factors (ACI), alternative income generating activities (IGA), and Quick alternative income source (QAS). That is livelihood diversification enables the farmers to get access to input factors, provide alternative income generating activities as well as serve as a quick alternative income source. Since cocoa production has a positive direct relationship with household income, all other things held constant, livelihood diversification has an indirect positive effect on household income through its contribution on cocoa production in the SWR. This positive effect of livelihood diversification on cocoa production is in line with the study of Ekow [49] and Aneani, et al. [50] who discovered that enhanced livelihood diversification would ultimately provide alternative income sources and as such would supplement household income. Similarly, Abimbola and Oluwakemi [51] said diversification supplements the farmers' income, while, Kimengsi et al., [52], reveal that educated household heads are significantly more likely to choose high-valued diversification strategies. Oyinbo and Olaleye [53] equally revealed that increase in the number of livelihood activities increases the farmers' income sources and hence, their income, purchasing power and welfare. However, since livelihood diversification has a direct negative relationship with welfare, it is strongly considered in this study as a means through which risk in production can be avoided among cocoa farmers in the SWR, especially risk averse farmers. This is in line with the "expected utility and decision theory" which sees diversification as one of the means through which risk can be avoided in the process of production. According to this theory increased

livelihood diversification will improve the producers' expected utility thus welfare, by maintaining or providing an alternative source of income during adverse periods of production [54-79].

5. CONCLUSION

A lot theoretical and empirical works identifies livelihood diversification as an alternative means through which households as well as individuals can increase their income and improve upon their welfare. This study operated with the assumption that, cocoa production was the only means of livelihoods of the cocoa farmers in the South West Region of Cameroon. Assuming that this assumption is true, then all factors determining cocoa production, all other things being equal will determine household income and thus welfare. As a result, all determinants of cocoa production in this study are considered as welfare determinants. However, it is intuitively difficult, if not, impossible for the farmers to depend completely on one source of livelihood for their survival, as such all other activities the farmers in the South West Region of Cameroon are involved in, from which they are capable of earning income was captured in this study by variable diversification, whose effect on the cocoa farmers' welfare have been the major preoccupation of this study. The study reveals that the effect of livelihood diversification on the farmers' welfare is negative. However, diversification has a positive effect cocoa production. This implies that increase diversification will increase cocoa output, because it enables the farmers to get access to input factors, provide alternative income generating activities as well as serve as a Quick alternative income source. Therefore, livelihood diversification has an indirect positive effect on household income, through its effect on cocoa production.

Even though livelihood diversification has positive effect on cocoa production, it has a direct negative significant effect on household income. This implies that, to an extent, less will be earned by the cocoa farmers when they diversify than when they do not. Therefore, in line with the "expected utility and decision theory" which identify diversification as one of the means through which risk can be avoided in the process of production, this study encourages cocoa farmers to diversification as a means of risk avoidance. This is further consolidated by the fact that climate variability (Temperature and

rainfall) in this study has a negative significant effect on cocoa production. Since this factor is one of the most determining natural factors of cocoa production, whose effect cannot easily be altered, diversification seems to be the only way-out. In order to avoid the risk and uncertainty involve in cocoa production given the present variability in climatic factors and the predicted further increase in the variability of these factors, the farmers are inspired by this study to diversify their livelihood activities. This will help sustain the farmer financially (smoothen their income/consumption) in case of any adverse effects on production that might affect income negatively such as climate and price drop among others. To this effect therefore, this study recommends the initiation of a policy that will enable the establishment of a "risk management scheme" (insurance scheme) for cocoa farmers which would include the following: *Production Insurance*, which compensates cocoa farmers for lower yield due to adverse weather, wildlife, pest infestation or disease and other disasters; *AgriStability*, which will compensate cocoa farmers for significant drops in their prices and farm income.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Gustavo A, Stamoulis K. Rural development and poverty reduction: is agriculture still the key? J Agric Dev Econ Div (Esa) FAO JADE. 2007;4(1):5-46.
2. Ravallion M. Measuring aggregate welfare in development countries. How well do national accounts and surveys agree? World Bank Working Wash DC. 2001;2665.
3. Diao X, Hazell P, Resnick D, Thurlow J. The role of agriculture in development: implications for Sub-Saharan Africa. IFPRI Report No. 153. Washington, DC: international food policy research institute; 2007.
4. MINADER. Report retrieved from the regional delegation; Annual Report 2012 for the South West. Ministry of Agriculture and Rural Development for Cameroon; 2012,
5. World B. World Dev Indic, CD; 2022.
6. eCAM3. Third Cameroon household survey; 2007.

7. eCAM. 4 Fourth Cameroon household survey; 2014.
8. MPI. Cameroon (Sub-Saharan Africa); 2021 global Multidimensional Poverty Index Briefing; 2021. Available: <http://www.ophi.org.uk>.
9. Robiglio V, Ngendakumana S, Gockowski J, Yemefack M, Tchienkoa M, Mbile P et al. Reducing Emissions from all land uses in Cameroon [final report]. STCP, International Institute for Tropical Agriculture BP 2008 Nkolbison, messa, Yaoundé, Cameroon; 2010.
10. Ruttan VW. "Productivity Growth in World Agriculture: Sources and Constraints." Staff Paper Series. Department of Applied Economics, College of Agricultural, Food and Environmental Sciences, University of Minnesota; 2002.
11. Molua EL, Lambi CM. The economic impact of climate change on agriculture in Cameroon; world bank development research group, sustainable rural and urban development team. Policy Research Working Paper 4364; 2007.
12. WDR. World development report: (development indicators). Agriculture for development; 2008.
13. Diao X, Breisinger C. Foreign inflows and growth challenges for African countries: an intertemporal general equilibrium assessment. IFPRI Discussion Paper 00967. Washington, DC: international food policy research institute; 2010.
14. Timmer CP. Agriculture and economic development. In: Gardner B, Rausser G, editors, Handbook of agricultural economics. Amsterdam: Elsevier Science. North-Holland; 2002.
15. Gbetnkom D, Khan SA. Determinants of agricultural exports: the case of Cameroon African Economic Research Consortium, AERC Research Paper 120Nairobi; 2002.
16. Armathé AJ, Mesmin T, Unusa H, Soleil BRA. 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; 2013.
17. NCCB (National Cocoa and Coffee Board). Cocoa Statistics. NCCB; 2013. Available from: oncc.com.
18. Klarer AJ. The evolution and expansion of cacao farming in south West Cameroon and its effects on local livelihoods; resources, agricultural systems and development (RESAD) [masters thesis]; Copenhagen University, Copenhagen AFS. 4Food, SupAgro. Montpellier: IRC; 2014.
19. FAO. The state of agricultural commodity markets. Rome: Food and Agriculture Organization, Commodities and Trade Division; 2014.
20. Bemieh CF. 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); 2013. Available from: <http://stud.epsilon.slu.se> [Degree thesis] No 829,ISSN 1401-4084. Uppsala;
21. Forgha NG, Tosam JN. An analysis of the socio-economic determinants of cocoa production in meme division, Cameroon. Greener J Bus Manag Stud. 2013;3(6):298-308. ISSN: 2276-7827.
22. Chinsinga B, Chasukwa M. And Otto Naess L. Climate change and agricultural policy processes in Malawi. Future Agriculture Consortium Working Paper No. 45, August. 2012'26.
23. Chambers R, Pacey A, Thrupp L. Farmer First: farmer innovation and agricultural research. London: Intermediate Technology Publications; 1989.
24. Kimenju SC, Tschirley D. Agriculture and livelihood diversification in Kenyan rural households. Nairobi, Kenya: Tegemo Institute of Agricultural Policy and Development; 2008.
25. Stifel DC. The rural nonfarm economy, livelihood strategies and household Welfare. Afr J Agric Resour Econ. 2010;4:82-109.
26. Lay J, Schuler D. Income Diversification and Poverty in a growing Agricultural Economy: the case of Ghana. Proceedings of the German development economics conference, Zurich. 2008;39:1-39.
27. Dimova R, Sen K. Is household income diversification a means of survival or A means of accumulation? Panel data evidence from Tanzania. Brooks World Poverty Institute Working Paper 122. Manchester. 2010;1-34.
28. Kimengsi JN, Mukong AK, Balgah RA. Livelihood diversification and household well-being: insights and policy implications for forest-based communities in Cameroon. Soc Nat Resour. 2020;33(7):876-95.

- DOI: 10.1080/08941920.2020.1769243.
29. Iyabano AH. Analyse du fonctionnement de la filière cacao (*Theobroma cacao* L.): une estimation des coûts et marges des acteurs (cas des régions du sud et sud ouest, Cameroun). Mémoire de fin d'études présenté en vue de l'obtention du Diplôme d'ingénieur Agronome. University of Dschang; 2012.
 30. Chambon B, Mokoko GS. 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. Versailles Cedex, France: Éditions Quae. 2013;185-96.
 31. Thalut N. Integration of financial exclusion into sustainable rice production for poverty reduction in Ndop. Bamili: university of Bamenda library; 2017.
 32. Kuntala L-D, Samanta G. Constructing social capital: self help groups and rural women's Development in India."Journal Compilation. Institute of Australian Geographers; 2006.
 33. Kondo T, Orbeta A. Dingcong, Jr. Clarence and Infantado Deirdre C, O, editors"Relly Martin. Paper presented in the International Conference held at Uganda Martyr's University, Nkozi. Christine. Kampala Umu press; "Impact of Microfinance in Rural Households in the Phillipines."; 1992.
 34. Navajas S, Meyer R, Gonzalez C, Schreiner V, Mark, Rodriguez J. M. Micro-credit and the poorest of the poor: theory and evidence from Bolivia. World Dev. 1999;28(2):333-46.
 35. Adams RH, Paje J. Impact of international migration and remittances on poverty, A. Paper Presented at the DFI/WB Conference on Migrant Remittance London. 2003;9-10.
 36. Okurut, Francis, Nathan, Margaret B, Ashie M: "Microfinance and Poverty in Uganda." Research Series. (41) economic policy research centre. Kampala: Makerere University; 2004.
 37. Yunus M. The Evolution of microfinance: Kalampur village in Dhaka, Bangladesh. AP photo/Pavel Rahman; 2004
 38. Anyanwu CW. Microfinance institutions in Nigeria policy, practice and potential. Paper Presented at the G24 Workshop on Constraints to Growth in Sub Saharan Africa. Pretoria: South Africa 29-30-2004; 2004.
 39. Chigozie UH. Access to and impact of credit on households welfare in Nigeria [MSc thesis]; Department of Economics University of Nigeria, Nsukka REG. NO: PG/MSc/09/ 51067; 2012.
 40. Bellemare MF, Fajardo-Gonzalez J, Gitter SR. Foods and fads: the welfare impacts of rising quinoa prices in Peru Working Paper No. 2016-06; 2016.
 41. Mukete N. Analysis of the technical efficiency of smallholder cocoa farmers in south West Cameroon. Am J Rural Dev. 2016;4(6):129-33.
 42. Biyase M, Zwane T. An Empirical Analysis of the Determinants of poverty and household welfare in South Africa, MPRA Paper No. 77085. The Journal of Developing Areas. 2018;52(1):115-30. DOI: 10.1353/jda.2018.0008.
 43. Ojo AD, Sadiq I. Effect of climate change on cocoa yield: A case of cocoa Research Institute (CRIN) farm. Ibadan, Oyo State: Oluyole Local Government. Journal of Sustainable Development in Africa. 2010;12(1). ISSN: 1520-5509. Available: http://jsdafrica.com/Jsda/V12NO1_Spring2010_A/PDF/Effectf.
 44. Kimengsi JN, Tosam JN. Climate Variability and Cocoa Production in Meme Division of Cameroon: agricultural Development Policy options. Greener J Agric Sci. 2013;3(8):606-17. DOI: 10.15580/GJAS.2013.3.022713505.
 45. Richman D. What drives efficiency on the Ghanaian cocoa farm? Ghana Institute of Management and Public Administration; 2010. Available: <http://www.csae.ox.ac.uk/conferences/2010-EDiA/papers/498-Dzene.pdf>.
 46. Effah ES, Yusif HM, Kwasi WB. Determinants of cocoa production in the Ashanti region International Standard Journal Number (ISJN) e-ISJN: A4372-2604 ISSN 2354 – 4147. 2017;5(1):21-5.
 47. Teal F, Zeitlin A, Maamah H. Ghana cocoa farmers survey 2004: report to Ghana cocoa board. Centre for the study of African economies. Oxford University; 2006.
 48. UNCTAD UN Conference on Trade and Development. Vol. 2004 [handbook]; 2004.

49. Ekow EA. Rural livelihood diversification and agricultural household welfare in Ghana. Available: <http://www.academicjournals.org/JDAE>. *J Dev Agric Econ*. 2011;3(7):325-34. ISSN 2006- 9774
50. Aneani F, Anchirinah VM, Owusu-Ansah F, Asamoah M. An analysis of the extent and determinants of crop diversification by cocoa (*Theobroma cacao*) farmers in Ghana. *Afr J Agric Res*. 2011;6(18):4277-87, ISSN 1991-637X.
51. Abimbola O, Oluwakemi A. Livelihood diversification and welfare of rural households in Ondo State, Nigeria. *J Dev Agric Econ*. 2013;5(12):482-9. DOI: 10.5897/JDAE2013.0497ISSN 2006-9774.
52. Kimengsi J, Pretzsch J, Kechia M, Ongolo S. Measuring livelihood diversification and forest conservation choices: insights from rural Cameroon. *Forests*. 2019;10(2):81. DOI: 10.3390/f10020081.
53. Oyinbo O, Olaleye KT. Farm households livelihood diversification and poverty alleviation in giwa Local Government area of Kaduna State, Nigeria. *J Sustain Dev*. 2016;15(1):219-32.
54. Ademiluyi IO. Determinants of smallholder farmers' welfare in Plateau State, Nigeria. Seahi Publications; 2014. *International Journal of Innovative Agriculture & Biology Research*. . 2014;2(4):11-16. Available from: www.se.ahipaj.org ISSN: 2354-293.
55. Anim-Kwapong GJ, Frimpong EB. Vulnerability of agriculture to climate change- impact of climate change on cocoa production. *Vulnerability Adapt*. 2010;(NCCSAP2).
56. Biyase M, Zwane T. An empirical analysis of the determinants of poverty and household welfare in South Africa. *J Dev Areas*. 2018;52(1, Winter):115-30. DOI: 10.1353/jda.2018.0008.
57. Challinor AJ, Simelton ES, Fraser EDG, Hemming D, Collins M. Increased crop failure due to climate change: assessing adaptation options using models and socio-economic data for wheat in China. *Environ Res Lett*. 2010;5(3):030412. DOI: 10.1088/1748-9326/5/3/034012.
58. Chayanov AV. 'Peasant farm organisation', translated in A. V. In: Thorner D, Kerblay B, Smith REF, editors (1966). *Chayanov: the theory of peasant economy*. Homewood, IL: Irwin Publishing; 1925.
59. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika*. 1951;16(3):297-334. DOI: 10.1007/BF02310555.
60. Elliot JS, Anthony PE. *The cocoa industry and child labour*. JCC 18. Council on Foreign Relations, Columbia University; 2005.
61. Fadipe AE, Adenuga AH, Ilori TE. Economic analysis of cocoa production in Oyo State, Nigeria. *Niger J Agric Food Environ NJAFEVOL*. 2012 588(4);8(4):58-63.
62. Folefack DP. Poverty and share revenue in Cameroon cocoa zone. *Agri-overseas*. 2010;28:184-90.
63. Fule B. Small-scale versus large-scale cocoa farming in Cameroon. Which farm type is more ready for the future? [cited May 20, 2016]; 2013. Available: http://stud.epsilon.slu.se/6438/1/Fule_CB_140218.pdf. Accessed [Master of Science thesis in agricultural] Food and Environmental Policy Analysis (AFEPA). Swedish University of Agricultural Sciences. Uppsala
64. Gockowski JJ, Dury S. The economics of cacao-fruit agroforests in southern Cameroon; 1999 [cited Mar 20, 2014]. Available from: <http://orton.catie.ac.cr/repdoc/A1599i/A1599i.pdf>.
65. IPCC. Managing the risk of extreme events and disasters to advance climate change adaptation. 2012;2012.
66. IPCC. *Climate Change 2022 Impacts, Adaptation and Vulnerability; Working Group II Contribution to the 6th Assessment Report of the Intergovernmental Panel on Climate Change*; 2022.
67. Kamdem CB, Gockowski GF, Hellene DB, Egg J, Dia B. K. What determines the price receive by cocoa farmers in Cameroon? An empirical analysis based on bargaining theory. *Afr J Agric Resour Econ*. 2010;5(2):318-39.
68. Kyereme SS, Thorbecke E. Factors affecting food poverty in Ghana. *J Dev Stud*. 1991;28(1):39-52. DOI: 10.1080/00220389108422221.
69. Lawal JO, Omonona BT, Oluwatayo IB, Oyekale AS, Salman KK. Welfare transitions and its correlates among cocoa farming households in Nigeria: an application of ordered probit approach.

- Paper prepared for presentation at the 2015 Agricultural & Applied Economics Association and Western Agric Econ Assoc Annual Meeting, San Francisco, CA, July 26-28; 2015.
70. Macchi M, Oviedo G, Gotheil S, Cross K, Boedhihartono A, Wolfangel C et al. Indigenous and traditional peoples and climate change. Int Union Conserv Nat, March 2008 Issues Paper; 2008.
 71. Meme M. Annual report for the Ministry of Agriculture and Rural Development, south west region, meme divisional delegate; 2013.
 72. Mukete N, Zhou L, Beckline M, Patricia B. Cocoa production in Cameroon: A socioeconomic and technical efficiency perspective. Int J Agric Econ. 2018;3(1):1-8. DOI: 10.11648/j.jiae.20180301.11.
 73. NCCB (National Cocoa and Coffee Board). Cocoa statistics.NCCB; 2015.
 74. Ndoping M. Cocoa and Coffee Risk Management in Cameroon: point of view of NCCB Cameroon in developing su-regional commodities exchanges. Global commod forum; 2011.
 75. Olaniyan O. The role of household endowment in determining poverty in Nigeria. J Niger Econ Soc. 2000;5:1-22.
 76. Oyekale AS, Oladele OI. Determinants of climate change adaptation among cocoa farmers in Southwest Nigeria. Available from: <http://www.ejournalofscience.org>. J Sci Technol, ICESR ISSN 2225-7217 ARPN. 2012;2(Special Issue):154.
 77. Sonwa D, Weise SF, Tchatat M, Nkongmeneck B, Adesina AA, Ndoye O et al. Rôle des agroforêts cacao dans la foresterie paysanne et communautaire au Sud-Cameroun. Réseau de Foresterie pour le Développement Rural:document du réseau; 2001.
 78. Tchokote J, Onyebuchi KO, Paul M, Nguetzet PMD. An economic appraisal of cocoa production in Cameroon: the case study of Lekie division. Available from: <http://www.iiste.org>. Journal of Economics and Sustainable Development ISSN 2222-1700 [paper] ISSN 2222-2855. 2015;6(9).
 79. Ngong JT, Akume DA, Njimanted GF, Vukenkeng AW. An empirical investigation of the determinants of cocoa production in the South West region of Cameroon. Int J Econ Com Manag. 2019;7(5):411-30.

© 2022 Ngong and Kimengsi; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/89409>