

Effects of Risk on Cocoa Farmers' Profitability in Ondo State, Nigeria

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Abstract: This study analysed cocoa farmers' attitude to risk and effects on their income in Ondo State, Nigeria. Multistage sampling technique was used to select a representative sample (234) for this study. Attitudinal Scale Approach (ASA) model, Gross margin and Likert's scale were used to analyse the data collected. Results showed that the mean age of the respondents was 50.27 years with an average of 15.98 years of experience. The sources of risks perceived by the cocoa farming households as threats to cocoa production were Natural risks (63.68%), social risks (88.89%), economic risks (75.21%), production risk (52.14%) and marketing risks (76.92%). The result of ASA model using Likert's scale showed that 37.61%, 36.75% and 25.64% of the respondents were respectively categorized as risk averse, neutral and preferring individuals. Results of costs and returns analysis of cocoa farms in the study area indicated that the average farm's profitability level was ₦185,423,725. Regression result showed that the variables that determine farmer's income included social risks ($p < 0.001$), economic risks ($p < 0.001$) and production risks ($p < 0.001$) and marketing risks ($p < 0.001$). The study concluded that plant diseases, theft of the crop, low market demand, low labour supply and instability of price among others are the severe types of risks that affect cocoa productivity and all year source of risk to cocoa production in the study area.

Keywords: Cocoa Farmers, Profitability, Gross Margin, Risks and Regression Analysis.

I. INTRODUCTION

Cocoa production in Nigeria is retarded by the declining productivity of the existing old cocoa trees. These old trees, coupled with their susceptibility to pest attack are responsible for the decline in the quality and quantity of cocoa production in the country. Cocoa production in Nigeria is undertaken mostly by poor, small holder and low technical capability farmers [3]. Cocoa is highly sensitive to changes in climate from hours of sunshine to rainfall and application of water, soil condition and particularly to temperature due to effects on evapo-transpiration. Climate changes could also alter stages of rates of development of cocoa pests and pathogens. It can modify host resistance and results in changes in physiology of host-pathogen or pest interaction. These factors alter cocoa yields, and thus results in low productivity (very low or decline from cocoa farming) and results into crop losses which, will impact socio-economic variables such as farm income (for example, cocoa farmers mostly suffer from risk (though, mostly income risk)), farm-level decision making, marketability and farmers' livelihoods.

Cocoa is highly susceptible to drought, and the pattern of cropping cocoa is related to rainfall distribution. Significant correlations between cocoa yield and rainfall over varying interval prior harvest of cocoa pods have been reported [3]. Cocoa seedling mortality is encouraged by a prolonged dry season (drought), short dry season affects pod filling, which will affect the bean size. In the mature cocoa plant, water deficit results in low yield and increases the level of capsid damage. The capsid is an insect that makes cocoa difficult to establish. Blackpod are the most destructive diseases that affect ripening cocoa pod. It is mostly related to climate and prevalent in the damp situation and most destructive during the wet season. The prolonged wet season, windy or cloudy days and rain slow down drying and processing of cocoa seeds, thereby reducing the value of the bean and increase the cost of processing. During the dry season, livestock or wild animals contaminate the bean [20].

With all these challenges, cocoa farmers in rural areas of developing countries face risky decisions regularly in their daily lives [10]. Such people constitute over two-thirds of the world poorest population who are located in rural areas and engage in subsistence agriculture which is a highly risky and uncertain venture [19]. Changes in weather and damage to crops or livestock from disease or pests make output uncertain [8]. While output prices (one of the marketing mix) are incentive to improvement in global crop supply, price volatility, on the other hand, discourages agricultural investment in terms of crop expansion [9]. Specifically, Climate change alters the development of cocoa pods, insect pests and pathogens, which translate into lower crop yields and impact farm income [1]. This implies that the risky decisions that the farmer takes have several effects on cocoa output on a yearly basis and in order to reduce the negative effects of risk, farmers employ some management strategies implying that cocoa farmers are risk-averse. Although, several authors have carried out research on agricultural risks and have discovered the major risks that farmers face but studies on the effects of cocoa farmers' risk attitudes on income, especially in Nigeria are very scanty. The objective of this study was therefore to fill this gap by evaluating the diversity of the effects of risks facing cocoa farmers and how this affects their income.

Despite the price increase of cocoa, its aggregate output showed a consistent decline in Nigeria, this was linked to the

structural weakness in the Nigerian economy. In addition to the consistent decline in the aggregate output of cocoa in Nigeria, is also susceptible to several risks such as unavailability of land, variation in producer prices among others [14]. It was also revealed by [5] that the major risks faced by cocoa farmers are pest and disease attack and excessive exploitation by exporters having the highest rank of marketing risks. Cocoa business, therefore, is extremely risky, leading to price speculations with consequences such as improperly dried beans due to unreliable and unfavourable prices which discourage farmers in investing in cocoa farms because cocoa price volatility. This predisposes cocoa farmers to income unpredictability and instability. Consequently, cocoa farmers mostly suffer from income risk, whereby the farmers are at the risk of earning negligible or zero income [16]. The sources of risk and their impact on the income of cocoa farming households can vary by farm size and farm type.

Agricultural production may be subjected to or experience multiple risks, with farmers and firms facing risks from different sources. These risks are often interconnected, some types of risk generally considered in agriculture, according to their sources are; Production, price and market, technological, financial, and weather related risks. Production risks is all about variations in crop yields and livestock production which is affected by weather conditions/climate change, pests, diseases, technological change as well as management of natural resources such as water. Price and market risks are associated with variability in output price (mostly), also input price variability and integration in the food supply chain (concerning quality, safety and new products). For examples are changes in supply and demand that impact domestic and/or international prices of inputs and/or outputs, changes in market demands for quantity and/or quality attributes, changes in food safety requirements, changes in market demands for the timing of product delivery, changes in enterprise/supply chain reputation and dependability. Technological risks are associated with the adoption of new technologies which result to low production of the cocoa. Financial risks result from different methods of financing the farm business, subject to credit availability, interest and exchange rates, etc. Human resource risks are associated with the unavailability of personnel [2].

Weather related Risks which can be periodic deficit and excess rainfall or temperature, hail storms, strong winds, major floods and droughts, hurricanes, cyclones, typhoons, earthquakes and volcanic activity. Finally, Biological and environmental risks included crop and livestock pests and diseases, contamination related to poor sanitation, human contamination and illnesses, contamination affecting food safety, contamination and degradation of natural resources and environment, contamination and degradation of production and processing processes. Policy and institutional risks are evidenced in the changing and uncertain monetary, fiscal and tax policies. Changing and/or uncertain financial (credit, savings, insurance) policies, changing and uncertain

regulatory and legal policies, and enforcement, changing and/or uncertain trade, market and land policies, governance-related uncertainty (e.g., corruption), weak institutional capacity to implement regulatory mandates [11]. For example in 1921, a unified Department of Agriculture was formed in Nigeria, after the amalgamation of the North and the South, the major policy of increase production of export crops such as cocoa, groundnut, oil palm etc. for the British market which was ready to absorb it for industrial growth [11].

II. METHODOLOGY

This study was conducted in Ondo State which comprises eighteen Local Government Areas. It lies between latitude 7.26N and longitude 5.36E. Its land area is about 15,500sqm. Ondo State is bounded on the east by Edo and Delta States respectively. On the west, it is bounded by Ogun and Osun states respectively and on the North by Ekiti and Kogi states as well as the Atlantic ocean, Institute of Food Security Environmental Resources and Agricultural Research (IFSERAR, 2009). The population of Ondo State is 3,895,367 (National Bureau of Statistic, 2010). The area has tropical wet and dry climate. The mean annual rainfall varies from between 1000mm and 1500mm. The vegetation of the area is mainly savanna and deciduous forests. The tropical climate of the state is broadly of two seasons: raining seasons (April to October) and dry season (November to March). The temperature throughout the year ranges between 21°C and 29°C and humidity is relatively high. The major occupation of the people is farming. The vegetation in the area favours the growth of trees and cash crops such as: cocoa, coffee, kola nut, rubber and subsistence crops like yam, cassava, maize and guinea corn. The people of the area are mostly Yoruba and they share similar customs and beliefs. Other economic activities in the area include trading and hand craft hand such as weaving, carpentry, dyeing and pottery.

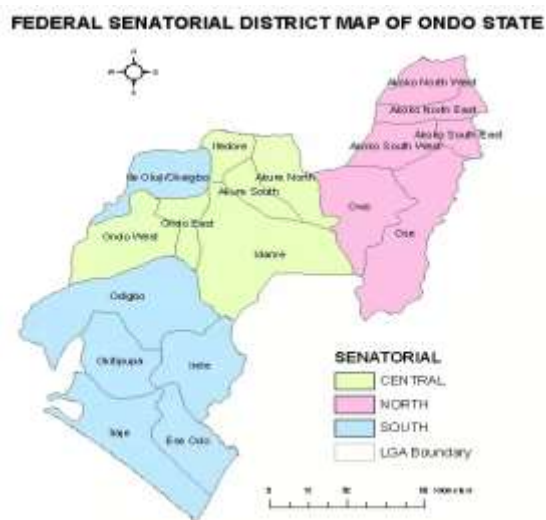


Figure 1: The map of Ondo State Nigeria [6]

Multistage sampling procedure was used to select a representative sample for this study. The first stage involved

the purposive selection of four local government areas(LGAs) out of the eighteen LGAs in the State, because of high concentration of cocoa farming in these areas. They are namely Okeigbo, Idanre, Ondo west and Ondo EastLGAs. The second stage involved random selection of villages proportionate based on size from each of the selected LGAs to arrive at 26 villages in all. Then, the third and final stage involved the selection of equal number of farmers (9) from each of the selected villages. In total, 234 cocoa farmers were proportionally selected on LGA basis . The selection procedure is shown in Table 1.

Table I: Sample selection procedure

LGAs	Number of Villages in LGA (A)	% of total = $A/\sum A * 100$ (B)	No. of villages Picked = $A/\sum A * 26$ (C)	Av. No. of farmers to be selected per village $234/26=9$	Number of Respondents to be selected per LGA = (C)*9
Okeigbo	160	26.02	$6.76 \approx 7$	9	63
Idanre	90	14.63	$3.80 \approx 4$	9	36
Ondo West	189	30.73	$7.99 \approx 8$	9	72
Ondo East	176	28.62	$7.44 \approx 7$	9	63
Total	615	100.00	26	9	234

The analytical techniques that were employed in analyzing the data were descriptive statistics, gross margin analysis and multiple regression model.

Gross Margin (GM) Analysis

Net Farm Income (NFI) and Gross Margin (GM) analyses were carried out. GM is the amount of money realized after deducting variable expenses or costs from total sales or income. NFI is obtained by adjusting net cash farm income for total depreciation, net inventory changes and value of products consumed at home. NFI, according to [12] is the only true measure of profit for the accounting period since it includes the above adjustment which could be quite large. NFI is the profit from the year’s operation and represents the return to the farm owner for personal and family labour, management and equity capital used in the rice farm.

$$\text{Gross margin} = \text{Total Income(TI)} - \text{Total Variable Costs(TVC)}$$

$$\text{NFI} = \text{GM} - \text{Total Fixed Cost(TFC)}$$

Multiple Regression Model

Multiple regression analysis was used to estimate the relationship between source risk among cocoa farmers and their profitability. The specification of general form of the multiple regression require that variable to be explained (dependent variable Y) be hypothesized as a function of independent variables $x_1, x_2, x_3 \dots x_n$. The general form of the multiple regression model is given below:-

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, e_i) \dots \dots \dots (1)$$

Where: Y = profitability (income); X_1 =Natural risk; X_2 =Social risk; X_3 =Economic risk; X_4 = production risk; X_5 = Marketing risk; e_i = error term.

Relevant data from the field were fitted into four functional forms, namely linear, semi-log, double-log and exponential functions. Hence the best functional form was selected based on the goodness of fit for regression (R^2) that is, coefficient of determination; t and F-values and signs and statistical significance of estimated regression parameters.

Linear form:

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + E \dots \dots \dots (2)$$

Where: β_1 to β_5 are the regression coefficients of the corresponding variables and other variables are as defined in the general form (eq. 1). A multiple regression analysis was used to establish the effect of source of risk. Multiple regression analysis was carried out using four functional forms, namely: the linear, semi-log and double log and exponential functions to choose the best fit.

III. RESULTS AND DISCUSSION

A. Socio-economic Characteristic of the Respondents

The result of the socioeconomic characteristics of the respondents is presented in table 1. The result showed that the mean age was 50.27 years and this implies that the most of the respondent are in their active age. This is in compliance with the work of [14] in their study that most of their population (46.1%) were made up of average people with the mean age of 54.45 years who were very active. The result in Table 3 also showed that majority of the respondents were male with the percentage of 88.03%, while the female ones were 11.98% . This implies that most of the respondents who were men were more energetic than women and this is in compliance with the findings of [13] in their study that majority (65%) of the respondents were male, while 35% were female. Furthermore, it was discovered that most of the respondents were married and that respondents in the study area will have additional responsibility to carried out to their spouses.

This is in agreement with the finding of [17] which revealed that 87% of the respondents are married, none is single, 0% is divorced, 0% is separated while 13% are widowed. It was also revealed in the table above that most of the respondents fell within the range of 11-20 years of experience with the mean of 15.98 years of experience. This shows that though most of the farmers little or no formal education they make up for this inadequacy by the skill they have acquired over a long period in cocoa farming. This is in compliance with findings of [18] who reveal that About 58% of the farmers had about 20 years’ experience in cocoa farming. Also from my findings, majority of the respondents had their secondary school education and were literates, at least they can read and write. This is in compliance with the

work of [10] on Food Security and Resource Allocation among Farming Households in North Central Nigeria and concluded that majority of the respondents 46.7% in the study area attained the level of secondary education. With regards to family size, the result showed that most of the respondents fell within the range of 6-10 number of household sizes with the mean of 7.69 and this result suggests that large household size can serve as source of family labour. This is in compliance with findings of [5] titled: Resource use efficiency and productivity of Cocoa Farmers in Idanre LGA of Ondo State, Nigeria, who reveal that most of the households size ranges between 6-10 household size. This study also revealed that majority of the respondents have less than or equal to one hectares of land for their cocoa production and have the mean value of 1.6. This is in agreement with Tijani, (2006) who find out that majority of the farmers are small holder producers with the farm size of 3.32 while the modal class is 0-2 hectares of land.

The result in Table II also indicated that majority of the respondents inherited their farm land. This is in

compliance with the work of [15], in their findings that majority of the respondents 65.8% in the study area obtained their farmland through inheritance. The study showed that majority of the respondents do not belong to any cooperative society (94.4%), this is in compliance with the findings of Babalola *et al.*, (2017) that majority of the respondents 74.2% in the study area does not belong to any cooperative society. The age of cocoa tree in the study area ranges from 1-41 years. The result in Table 3 also revealed that most of cocoa trees in the study area fell within the range of 31-40 years old with the mean age of 29.02. This is in compliance with the findings of [5] discovered that most of the cocoa farms in Ondo and Osun state were very old with low productivity. The result also showed that majority of the respondents harvest 6-10 bags of cocoa yearly and have the mean value of 6.39. This is in agreement with [4] which reveal that majority of the farmers harvested less than or equal to seven bags of cocoa yearly. This signifies a low production output in cocoa. The old cocoa farms could be responsible for this and the implication of this low output is low income for the farmers.

Table II: Socio economic characteristic of the respondents

Age in years	F	%	Marital status	F	%	Household size	F	%
<=30	7	2.99	Single	10	4.27	1-5	64	27.35
31-40	40	17.09	Married	202	86.32	6-10	125	53.42
41-50	92	39.32	Divorced	13	35.56	11-15	32	13.68
51-60	47	20.09	Separate	0	0.00	16-20	6	2.56
>60	48	20.15	Widow	9	3.85	Above 20	7	2.99
Gender	F	%	Cooperative Member	F	%	Farm size	F	%
Male	206	88.03	Yes	13	5.6	≤1	157	67.09
Female	28	11.98	No	221	94.4	≥2	77	32.91
Mode of land acquisition	F	%	Age of cocoa trees	F	%	Bags of cocoa(100Kg)	F	%
Rent	15	57.69	1-10	12	5.13	<5	13	5.56
Inheritance	135	8.55	11-20	35	14.96	6-10	161	68.80
Family land	20	21.37	21-30	34	14.53	11-15	39	16.67
Purchase	50	3.85	31-40	151	64.53	16-20	18	7.69
Borrow	9	3.85	>40	2	0.85	>20	3	1.28
Years of farming experience	F	%	Educational status	F	%			
1-10	86	36.75	None	42	17.9			
11-20	94	40.17	adult education	9	3.8			
21-30	32	13.68	primary education	13	5.6			
31-40	12	5.13	secondary education	134	57.3			
>40	10	4.27	Tertiary	36	15.4			

B. Risk encountered by cocoa farmers.

Table III shows the identified risks that posed threats to cocoa production and out of all the assessed natural risks associated with cocoa production, plant diseases have the highest percentage (63.68%). This could be as a result of changes in climatic conditions that vary. Pests attack have the lowest percentage (1.28%) and this implies that cocoa is

susceptible to disease in the study area which can lead to reduction in output and in turns reduce the income of the farmers. This is in line with findings of [5] where majority of the natural risk faced by the cocoa farmers are plant diseases and pest damages impact. Also from all the assessed social risks associated with cocoa production theft of crop have the highest percentage (88.89%) which may result from insecurity

in the country most especially in the rural area meanwhile embezzlement of the money realized from the sale of the crop have the smallest percentage (11.11%), which implies that majority of the farmers output is being stolen by stranger which will lead to the reduction in quantity of output and reduction in income of farmers. Among the assessed economic risks associated with cocoa production, low market demand have the highest percentage (75.21%) this is as a result of improper drying of the crop while interest on borrowed capital have the lowest percentage (24.79%).

Also considering production risk associated with cocoa production, labour supply have the highest percentage (52.14%). This could be as a result of youth migration from the farm in search of white collar job and this have implications of farm activities. The lowest in production risk categories which is processing of the crop account for 0.85% percentage. This implies that majority of the youth that can perform the farm work effectively have migrated to the city and this will have a negative effect on the farmers' productivity and income. Finally results from all the assessed marketing risks associated with cocoa production revealed that instability of price have the highest representation of 76.92%. This could be as a result of lack of implementation of favorable government policy can affect the price of the crop, thereby putting the farmers at risk. While lack of information recorded the smallest percentage (3.85%). This can be as a result of illiteracy of the farmers which put the farmers at risk.

Table III: Identified risks that posed threats to cocoa production

Risk encountered		Frequency	Percent
Natural risk	Drought	6	2.56
	Flood	4	1.71
	Excessive rainfall	5	2.14
	Plant diseases	149	63.68
	Insects	67	28.63
	Pest	3	1.28
	Total	234	100
Social risk	Embezzlement of money	26	11.11
	Theft of the crop	208	88.89
	Total	234	100
Economic risk	Interest on borrowed capital	58	24.79
	Low market demand	176	75.21
	Total	234	100
Production risk	Effect of chemical	35	14.96
	Credit facilities	40	17.09
	Labour supply	122	52.14
	Storage facilities	35	14.96
	Processing	2	0.85
	Total	234	100
Marketing risk	Lack of information	9	3.85
	Instability of price	180	76.92
	Change of government policies	45	19.23
	Total	234	100

Profitability Estimates of Cocoa Farmers in the study area

Results of costs and returns analysis of cocoa farms in the sample survey is presented in Table IV. From the table it could be seen that the average revenue from cocoa output was found to be ₦206,102,500.00 per annum. The total variable cost incurred was ₦8,460,975.00 and the Gross Margin of Cocoa Farmers were ₦197,641,525, while the Net farm income was ₦1,634,182.72. The profitability level using the Net Farm Income is ₦185,423,725.00 implying that the business of cocoa production is profitable. In terms of sustainability the profitability of this business is expected to be a major factor that can motivate the farmers to continue in this business while those who are aware of the profitability inherent in this business can take to cocoa farming as a way of earning their living. This implies that Cocoa has exhibited its potentials in being a source of job creation and poverty alleviation as profits earned from the business will help the farmers meet up with their household needs and even make them to be employers of labour in this enterprise. This is in agreement with the work of [15] who revealed that the business of cocoa production is profitable.

Table IV: Estimated Profitability of Cocoa Farms in the Study Area

ITEMS	Amount in Naira (₦:K)	Total Amount (₦: K)
Total Revenue		206,102,500
Less Variable Costs		
Planting Materials	730500	
Fertilizers	572500	
Insecticides	1875100	
Herbicides	2124500	
Pesticides	1761575	
Labour	1872600	
Total Variable Costs		8,936,775
Gross Margin		197,165,725
Less Fixed Costs		
Rent on land	10,972,000	
Cost of equipment	1,245,800	
Total Fixed Cost		12,217,800
Net Farm Income		184,947,925

Regression Result:

Effects of source of risk on profitability of cocoa farmers Table V shows the sources of risk that influence the profitability of the cocoa farmers include: natural risk, social risk, economic risk, production risk and marketing risk. The value of R^2 (0.281) indicated that the explanatory variables considered in the study together explained about 41 percent variation in risk attitudes of farm households. The value of R^2 obtained found that there was systematic relationship between the types of risks affecting the farmers and their total income. The results of the multiple regression analysis of the four

functional forms showed that the exponential function had the best fit (Table V). In addition, there was a negative and significant (1% level) relationship between the social risks and farmers' income. This implies that as the farmers' social risks increases by 1 unit, their total income decreases by 1.4%, and thereby increasing risk attitude. The analysis also showed that economic risks is statistically significant (1% level) and negative relationship with the total income, implying that with the increase in the economic risks that affects the respondents, the total income decreases. Moreover, a positive relationship was observed between production risks and the total income of the farmers, and this was statistically significant at 1% level. This implies that as the production risks increases so as the total income of the farmer increases. The result further showed a negative and significant (1% level) relationship between marketing risks and farmer's total income. With increase in the marketing risks, aggregate income decreases (risk preference/taking attitude).

Table V: Multiple regression estimates (exponential) for the relationship between different source of risk and cocoa farmer income.

Variable	Coefficients	Standard Error	p-value	Mfx
Natural risk	-0.0033	0.0021	0.114	0.113
Social risk	-0.0147	0.0043	0.001***	0.001
Economic risk	-0.0080	0.0030	0.008***	0.008
Production risk	0.0300	0.0054	0.000***	0.000
Marketing risk	-0.0158	0.0036	0.000***	0.000
Constant	2.3568	0.0224	0.000***	

*, **, *** Represents 10%, 5% and 1% significant levels

mfx = Marginal effects

No. of Ob.	F(11, 222)	Prob> F	R ²	Adjusted R ²	Root MSE
234	7.87	0.0000	0.2805	0.2449	0.03795

IV. CONCLUSION

The study concluded that plant diseases, theft of the crop, low market demand, low labour supply and Instability of price among others are the severe types of risks that affect cocoa productivity in the study area. Moreover, farm households in the study area were more of risk averse attitude than risk taker.

The study recommends that there is need for all stakeholders (policy makers, non-governmental organizations, community based organizations, development partners etc) to factor-in more actions on risk management/coping strategies in policy making. Moreover, with the coming on board of Nigeria Incentive-Based Risk Management System for Agricultural Lending (NIRSAL) there is need for government to ensure that the risk-sharing facility window of NIRSAL should

network with Microfinance Institutions (MFIs), Microfinance Banks (MFBs), Commercial banks etc, which actually have farmers as focus in their credit facilities.

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