Analysis of Production-risk Factors on cocoa farming and Income in Ondo State, Nigeria

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ABSTRACT— Cocoa Farming is a major income earner of the majority of the farmers in the areas of study. Past studies have revealed that these farmers are threatened by various types of production risk, such as drought, inconsistent production, low yield, pest and disease infestation, age of cocoa tree, natural disasters among others. This study examines the production risk factors influencing income generation on cocoa farming as well as the degree of effect of these production-risk factors on cocoa livelihood. A multi-stage sampling techniques was used to select 160 respondents. Method of data analysis used are descriptive statistics and multiple regression analysis. Descriptive analysis results revealed that the with mean of age of cocoa farmers in the area of study was 39 years. The study deduced that this is an active age that can be used to enhanced cocoa production, adoption of new technology and good agricultural practices. The study identified various level of production risk factors among which are Drought, Price Spike and Inconsistence in productions as the dominant ones. The study revealed that 96.3% of the cocoa farmers were aware and 75% of such farmers indicated the effect of these risks on their cocoa production with various level of degree. Multiple regression analysis results deduced the robustness of the independent variables considered in the equation. The result of the diagnostic revealed the multiple coefficients of determination of the dependent variable of income by the independent variables of 52%. Indicating that 52% of the explanatory variables explained the dependent variable, however, the 48% unexplained variables might be due to reason beyond the scope of this study and which might be considered in the future study. Based on the estimated results, 8 variables are found to have significant influences out of 14 variables considered in the equation to have influenced on cocoa farmers' income. The study deduced that the dominant production risks of drought, price spikes and production inconsistences has mean effect of 66.7% on cocoa production in the study areas. This is significant; hence the study recommends the risk management strategies of crop insurance, access to timely credit facilities, training on the risk management strategies, efficient marketing policy delivery and government to be consistence on their policy on commodities particularly on cocoa marketing and grading and this study found out that these are the most dominant production risk factors confronting cocoa farmers from making commeasurable income from cocoa farming.

KEYWORDS: Cocoa, Production Risk, Economic analysis, Ondo State.

1. INTRODUCTION

Agricultural and related agricultural activities have provided livelihood for majority of people and has been a significant contribution to gross domestic product of most developing countries [18], [11]. Past study contended that agriculture is an activity burdened with a multiple risk factor [24]. Literature argued that risk associated with agriculture are uncertainties in weather, yields, prices, and wide fluctuations in farm incomes among others [20]. Hence, farmers have to deal with a significant amount of uncertainty and risk every day [36]. Risks outcomes can have significant cascading effects on agricultural outputs [40]. This effect can come in the form of lower yields resulting to poor incomes [19]. Risk is inherent in all business activities and past studies have argued that agribusiness activities are more prone to risk than any other income generating activities [11], [23]. This is argued from the point of peculiar nature of agriculture, which is dependent on

climatic and environmental conditions [16]. Some risks associated with crop production include: biological (insects, pests and diseases), climatic (droughts, floods), price (volatility of input and output prices), and financial (credit unavailability and fluctuations in interest rate) [38].

Risks in agriculture have been a matter of worldwide concern since 1933, when the risk analysis framework was outlined [43], [32]. [10], [8] outlined five distinct risk factors in agriculture, these are production risk, marketing risk, credit risk, personal risk and environmental risk. According to this study production risk has been the most dominant. Production risk is the risk associated with production losses. Risk associated with crops yield include weather events such as drought, excess moisture, hail, freeze and flooding, crop pests and disease among others. Past studies contended that production risk is likely to grow due to the influence of climate change and globalization. [39], [38] argued that and if these risks are not properly managed, it can be a disastrous to agricultural outputs reducing agricultural income. Past work identified that one of the initial causes of the 2007/08 world food price crisis was as a result of production risk related to severe droughts that influenced poor agricultural outputs [19], [30]. Hazell (1992) indicated that agricultural risks seem to be prevalent throughout the world; however, they are particularly burdensome to farmers in the developing countries.

Literature contended that among the perennial tree crops, Cocoa (*Theobroma cacao*) has attracted greater risk [31]. Cocoa (*Theobroma cacao*) is of particular interest in the west and central Africa from where approximately 70% of the world supply of cocoa originates [13]. World cocoa bean production in 2013 was estimated at 4.6 million tonnes and by 2019, the annual production of cocoa is estimated to have grown to be almost 5 million tonnes. The cocoa sector is an important source of livelihoods, providing revenue for 40 to 50 million cocoa farmers mostly in developing countries [2]. An estimated 5 million farming households depended on cocoa as a cash crop. Out of these cocoa farming households, 70 per cent comes from smallholders living on less than USD 2 per day [32]. The cocoa and chocolate industry also generate jobs in importing countries. Cocoa beans are often exported for processing and sale to end consumers. In 2018, cocoa sector supported about 2,000 companies in the European Union and 650 companies in the United States, employing about 70,000 people [41].

Moreover, there has been an increase in the demand of cocoa at the international market due to the boom in the chocolate consumption [5]. However, the production of cocoa is declining from the producing states, most especially in West Africa countries. Past study identified one of the major factors responsible for this decline is the production risk like fertilizer prices and pest and diseases [5]. Cocoa (*Theobroma cacao*) is an important tree crop that has played significant role in Nigeria Economy, especially in providing jobs and income to farmers, raw materials for the industry and foreign exchange for the country [26]. Cocoa is primarily produced by hand and its production has never experienced widespread mechanization [1].

Cocoa Farming is one of the main occupations and a major source of income among famers in Ondo state. It is the second highest earning agricultural export in Nigeria [6]. Records from NBS 2019 revealed that cocoa generated over $172.7m (#66.7billion) in the first three quarters of 2019 [25]. Cocoa farmers are threatened by various types of production risk e.g. inconsistent production, low yield, pest and disease infestation, high cost of acquiring equipment, increase in production sustainability when considering modified varieties, cost of managing crop, organizing chain cost of quality control in meeting numerous customer satisfaction [22], [7]. Nigerian cocoa output in 2021/22 is likely to fall by at least 20% from the previous season as measures aimed at curbing the spread of the novel coronavirus and drier weather increase the chances of a poor harvest. The country's cocoa output for the 2020/21 season declined to 250 thousand tons, lower than the International Cocoa Organization's forecast of 260 thousand. Nigeria, the world's fifth largest cocoa producer, has been hurt

by these risks while drier weather has hindered pod formation [26]. The knowledge of production risks in Cocoa farming is crucial as this will enable the study to develop coping strategies to minimize and adapt to these risks in order to reduce the effect of risk on cocoa outputs [42], [21].

Past studies have provided risk management strategies, these are crop insurance, forward contracting, precautionary savings, spreading sales, crop diversification, off-farm job, pesticide application, use of improved seed varieties, and membership of cocoa farmers' cooperative [35], [15], [9]. [30], indicated that farmers' choice of risk management strategies is determined by age, farm size, risk aversion, innovativeness and source of risk. Ondo state is the largest cocoa grower in Nigeria and accounts for about 40% of national production, estimated at 280,000 to 300,000 tons of cocoa per season [29]. It is the first state in Nigeria to set the one-kilogram-per-tree target [33]. [37] investigated the effect of climatic variables in cocoa seedling raising, production and processing and also assessed the degree of vulnerability and coping strategies adopted by the farmers. The study indicated that production risk such as rainfall, temperature and sunshine were the most important climatic factors that influenced poor cocoa production.

There are been dearth of research on risk attitude and management strategies among cocoa farmers in Ondo State [32], [30], Dadzie and Acquah, 2012 [8]. These studies noted that risk management strategies cocoa farmers employed has improved cocoa production tremendously. In addition, past studies outlined that on-farm strategies can help to reduce the magnitude of the yield associated with some of these production risks; like judicious crop selection, crop insurance, reducing the use of chemicals, planting of improved cocoa seeds, used of appropriate pesticides and irrigation among others. In view of the above, there is a need to seek for strategies that will help to minimize farmer's vulnerability to risks, and to help identify agricultural risk management strategies that will suite the farmers in Western Agricultural Zone of Ondo state. Hence, the paper examined various production risks faced by cocoa farmers, its effect on income generation and management strategies adopted to minimize production risks.

2. METHODOLOGY

2.1 STUDY AREA

The study was carried out mainly in Idanre/okeigbo, and Odigbo local government areas of Ondo State, Nigeria. The chosen areas are the major cocoa producing areas in Ondo state. Ondo state is the largest producer of cocoa in Nigeria. Cocoa production in Ondo state is largely facilitated by small scale farmers of which the men are actively involved in the process Ondo state records an output capacity estimated at 77,000 tons per annum [26]. It is one of the thirty-six States of Nigeria located in the southwest part of the country. It was created in February 3, 1976 from the former western state. It originally included the present Ekiti State, which was split off in 1996. It is bounded by the states of Kwara and Kogi on the north, Edo on the East, Delta on the southeast and Osun and Ogun on the west and by the bight of the Benin of the Atlantic Ocean on the south. Ondo state includes mangrove-swamp forest near the bight of Benin, tropical rain forest in the centre part and wooded savanna on the gentle slopes of the Yoruba Hills on the north. Ondo state is situated in the western part of the country. Ondo state is located within the agro-ecological zone and this supports agricultural activities in the state. The state is much inclined to agriculture which contributes to over 70% of the state's gross domestic products.

2.2 SAMPLING PROCEDURES AND SAMPLE SIZE DETERMINATION

Multistage sampling was used for data collection. The first stage involves random selection of 2(two) local government areas in Ondo State. The second stage involves the random selection of 4(four) villages each from the two local government stated making 8 (eight) villages. The third stage involves random selection of 20

(twenty) respondents from each villages making 160 respondents that were used

Table 1: Sampling areas

State	Local government	Villages	Number of farmers
Ondo state	Idanre/ileoluji	Ofosu	20
		Odunwo	20
		Bajare	20
		Arapa	20
	Odigbo	Omituntun	20
		Oniparaga	20
		Araromi obu	20
		Agbagu	20
	Total		**160**

Source: field Survey, 2021.

2.3 METHOD OF DATA COLLECTION

Data for the research was collected through primary sources. Primary data was obtained from cocoa farmers through the use of structured questionnaire. The questionnaire is structured to collect information on risk associated with cocoa production from cocoa farmers in the selected local government areas of Ondo State. Moreover, questionnaire is structured to collect information on a number of pre-determined list of risks and management/coping strategies adopted to cope or manage these risks.

2.4 METHOD OF DATA ANALYSIS

2.4.1 Descriptive statistics

Descriptive statistics such as percentage, mean, frequency distribution was used to present data using Statistical Package for Social Scientist (SPSS).

2.4.2 Gross Margin Analysis

Gross margin analysis was employed to determine the profitability of cocoa farmers under the management of production risks. Past study deduced that Gross margin is the variation between total revenue (TR) and total variable cost (TVC) [28], [27]. Hence, the mathematical notation for the analysis is presented below:

$$GM = TR - TVC \qquad (1)$$
$$TR = Pq \qquad (2)$$
$$TVC = PcM \qquad (3)$$

where GM=Gross Margin, TR =Total Revenue, Pq = Price of the Vegetable per kg, q
Pcm = Market price of variable input.

Also, the Net Revenue (NR) was likewise calculated using the formula as follows:
$$Net\ Revenue = Total\ Income - Total\ Cost$$
$$Total\ Cost = Fixed\ cost + Variable$$

Gross Margin is used to analyze objectives 3 and 4 which is looking at how production risk has effect on their income.

2.4.3 Multiple regression model

Multiple regression model was used to estimate the degree of association between the two variables (independent and dependent) and also measured the causal relation between these variables. While T-test analysis was used to test the significant levels of each independent variables used in the model.

The Multiple regression model functional forms were tested for suitability in terms of the highest number of significant variables arrived at, lower standard error, higher multiple determination (R2) of the coefficients and low/absolute no correlated variables used in the model. Hence, linear functional form of the model used and it is stated as:

2.4.4 Linear function

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} + b_{14}X_{14} + b_{15}X_{15} + b_{16}X_{16} + ei \qquad (4)$$

Where Y = Income (Gross Margin analysis)
X_1 = Age (Years)
X_2 = Sex
X_3 = Religion
X_4 = Educational Attainment
X_5 = Marital Status
X_6 = Family Size
X_7 = Livelihood Secondary Sources
X_8 = How do you acquire cocoa farmland
X_9 = Cocoa farmland size
X_{10} = When do you start planting cocoa
X_{11} = Source of capital for cocoa farming
X_{12} = Amount of loan received
X_{13} = Sources of raw materials
X_{14} = Production Risk (Drought)
X_{15} = Production Risk (Price Spikes)
X_{16} = Production risks (Inconsistent Production)
X_1 …………..X_{16} = Independent Variables
ei = Error

2.4.5 Estimation technique

Past studies deduced that in the build up of model several assumptions have to be fulfilled in order to determine appropriate techniques to used [3], [34]. In this study, random sampling technique was used in the sample selection. The choice of this technique was based on the assumption that, the sample frame was known and the samples displayed randomness. When this happens the estimation technique to be adopted can be ordinary least square method (OLS). Hence, this study adopts OLS method for its estimation technique.

3. RESULTS AND DISCUSSION

3.1 Respondents' Socioeconomic Characteristics

The results of the analysis revealed shows that cocoa farmers' age distribution was between 18-29 years (28.8%), 30-39 (22.5%), 40-49 (25.0%), 50-59 (16.3%), and 60-69 (7.5%). Majority of the cocoa farmers' falls between the age ranges of 18-29 (28.8%) (Table 2). Mean (average age) of farmers of 39 years (38.8 years) as the study reveals. This result implies that majority of the farmers are young and agile, productivity

can be enhanced and adoption of technology can easily be enriched. In addition, majority of the farmers (88.7%) are male while (11.3%) are female that are involved in cocoa farming activities. The implication of this findings indicated that cocoa farming is a drudgery activity that needs physical strength and influence which the female folks can rarely provide. This assumption was supported by [4] in their study that revealed majority of farmers being male can be attributed to lack of easy access to loans for production activities by female farmers as compared to their male counterparts. Also, [31] argued that this is a case of gender discrimination, rather than ignorance, is the justification for the lack of female participation in agricultural programs and projects. Hence, this study suggested that urgent steps need to be taken by our policy makers to addressed the issue of gender discrimination in agricultural production. Female gender needs to be encouraged as study revealed that female folks are better manager of natural resources [14].

The table 2 also shows that the age group involved in cocoa farming for each of the local government area considered are below 40 years of age thus implies that cocoa farming is done majorly by the youth, in addition, the study revealed that the age-range of 18-29 participated actively in cocoa business that any other age-category.

The marital status analysis of the respondents revealed that majority of the cocoa farmers 67.5% are married, 25.0%) are single, while 5.0% are widow/widowed and 2.5% are divorced/separated. Evidence from Table 2 indicated that cocoa farming households in the study areas are moderate as the study reveals that the mean household size of the respondents was 5. This result implies that there will be more family labour to assist on cocoa farm. The study also revealed that majority of the farmer (26.3%) are illiterate with no educational background, while 16.3% have primary education, 23.8% have secondary education. Others are post-secondary schools' education attainment are 21.3% possessed National Certificate in Education (OND) or Ordinary national Diploma (OND0, while 10.0% have Higher National Diploma (HND) or Bachelor of Science Degree (BSC). However, about 2.5% attained Master degree programme. The study further analyzed the effect of education on farmer's performance in cocoa production, the study revealed that the level of illiteracy of the cocoa farmers have effect on the farm size. Table 2 revealed that cocoa farmers with larger farm size have at least secondary education. The table also indicated that about 50.0% of the cocoa farmers borrow less than 100,000, while 33.8% get a loan between 100,000 and 500,000, 12.5% get loan between 500,000 and 1,000,000 while the remaining (3.8%) get a loan above 1,000,000. The implication of this finding is that education has effect on the effectiveness of the management of farms and also enhanced accessed to credit facilities.

TABLE 2: Percentage distribution of the Socio-economic Characteristics of the respondent

Characteristics	Frequency	Percentage
Age (years)		
18-39	82	51.3
40-59	66	41.3
>60	12	7.5
Total	160	100
Mean	38.8	
Sex		
Male	142	88.8
Female	18	11.3
Total	160	
Marital Status		
Single	40	25.0

Married	108	67.5
Divorces/separated	4	2.5
Widowed	8	5.0
Total	160	100
Family Size		
1-5	90	56.3
6-10	64	40.1
> 11	6	3.8
Total	160	100
Religion		
Christianity	122	76.3
Islam	30	18.8
Traditional	8	5.0
Total	160	100
Education status		
No formal education	42	26.3
Primary	26	16.3
Secondary	38	23.8
NCE/OND	34	21.3
HND/BSC	16	10.0
Total	160	100
Amount of loan received		
<100,000	80	50
100,000-500,000	54	33.8
500,000-1,000,000	20	12.5
>1,000,000	6	3.8
Total	160	100

Source, field survey 2021

3.2 DISTRIBUTION OF FAMILY SIZE AND SEX OF HOUSEHOLD HEADS

The table 3 below shows the size of household could provide important information on the income generation, food processing and livelihood activities because of its possible correlation with welfare. Evidence abounds pointing to the fact that poor people tend to live in large size households while non-poor tend to live in small size households [14]. The impact of large family size is such that it reduces the per capita expenditure of the family thereby aggravating poverty in the household. The distribution of the family size is shown below:

Table 3: Family size grouping and gender cross tabulation

		Sex			
		Male	Female	Total	Percentage
Family size grouping	1-5	80	10	90	56.25
	6-10	56	8	64	40
	11-15	6	0	6	3.75
Total		**142**	**18**	**160**	

Field survey, 2021

The result from table 3 shows that about 56.25% of the households falls between household sizes 1-5. This outcome is large enough to attract high dependency burden in terms of many mouths to feed. Family size enhances per capita expenditure even though it can reduce it. The implication of this finding is that the higher

the dependency burdens the more the household consumed from farm outputs, thus, reduces marketable farm output sold, reducing household incomes and gravitates towards poverty status [17].

3.3 Distribution of Sex and marital status of respondents
Table 4 shows that it is a known fact that gender relations largely determine household security, provisions as well as poverty status [14]. It is known from the table below that 25% are single, 67.5% are married, 2.5% are divorced/separated and 5% are widowed with the highest been married implies that there exists a mutual benefit derived in working together as husband and wife, where risks are spread, better decision-making opportunity and larger pool of resources existed for the enhancement of the family.

Table 4: marital status and sex crosstabulation

| | | Sex | | Total | Percentage |
		Male	Female		
Marital status	Single	40	0	40	25
	Married	92	16	108	67.5
	Divorced/separated	4	0	4	2.5
	Widowed	6	2	8	5
Total		**142**	**18**	**160**	

Field survey, 2021

3.4 Distribution of amount of loan received and cocoa farm size
The amount of loan received could provide important information on cocoa farm size. Table 5 below results indicated that those farmers that receive loan higher than 1,000,000 has the least farm size with 3.75%, the table also indicate that 33.75% received loan within 100,000 to 500,000.

Table 5: Cocoa farm size and amount of loan received crosstabulation

| | | Cocoa farm size | | | Total | Percentage |
		1-3.9	4-8.9	9-1000		
Amount of loan received	Less than 100,000	36	42	2	80	50
	100,000 to 500,000	6	36	12	54	33.75
	500,000 to 1,000,000	0	8	12	20	12.5
	More than 1,000,000	0	0	6	6	3.75
	Total	**42**	**86**	**32**	**160**	

Field survey, 2021

3.5 Identifying production risks and its effect on farming activities
Table 6 shows various production risks cocoa farmers were exposed to, 13 various risks were listed, these are the dominant production risks, The study revealed that out of these 13 indicators listed, 11 of these indicators had significant effect (60% and above) on cocoa production (Table 6). Moreso, transportation cocoa products and Government policy production risk factors are the most dominant (99.4%). In addition, high production risk factors are Natural disaster (94%), Pests and Diseases (93.8%), increase in inputs cost for production such as cocoa seedlings and fertilizer attracted 91.3%, price spikes 83.1%, inconsistence in production, 81.9% and drought 75% (Table 6). The study deduced that all the risks factors listed is known by the cocoa farmers but lack in-depth knowledge on how to mitigate but only coping and adapt to the situation. This situation has really affected their productivity leading to poor outputs from cocoa production and enhanced poor income.

Table 6: show the rate at which different production risks affects respondents.

Variables	Frequency	Aware Percentage	Frequency	Affecting you farm Percentage
Drought	154	96.3	120	75.0
Price spikes	155	96.9	133	83.1
Inconsistent production	160	100	131	81.9
Pests and diseases infestation	156	97.5	150	93.8
High cost of acquiring equipment	139	87	104	65
Equipment breakdown	143	89	70	44
Increase in production sustainability	159	99.4	146	91.3
Natural disaster	159	99	151	94
Age of cocoa	137	86	54	34
Government policy	159	99.4	159	99.4
Labour	151	94.4	100	62.5
Transportation of cocoa products	159	99.4	159	99.4
High cost of interest rates on borrowed loans	159	99	138	86.3

Source: field survey, 2021

3.6 Percentage distribution of effect of production risks on farming activities

The table 7 shows that 96.3% of the respondents are aware of drought as a production risk, 96.9% are aware of Price spikes as production risk and 100% of the respondents are aware of inconsistent in cocoa production. The table shows the highest production risk known by the farmers.

Table 7: Rate of Awareness of Production

Variables	Frequency	Aware Percentage
Drought	154	96.3
Price spikes	155	96.9
Inconsistent Production	160	100

Source: field survey, 2021

The table 8 below shows that 75% farmers have been affected by drought, 83.1% are affected by price spikes while 81.9% were affected by inconsistent production.

Table 8: Rate of effect of production risks

Variables	Frequency	Affecting your farm Percentage
Drought	120	75.0
Price spikes	133	83.1
Inconsistent Production	131	81.9

Source: field survey, 2021

3.7 Evaluation of lowest production risks affecting cocoa production

From the result analysis in table 9, it was revealed that 54% of farmers are aware of Age of cocoa as production risk, 94% of farmers are aware of labour as production risk while 89% farmers are aware of equipment breakdown as production risk. The analysis revealed that most farmers are not aware of age of cocoa, labour and equipment breakdown as production risk.

Table 9: how aware are you of the following risks?

Variables	Frequency	Aware Percentage
Age of cocoa	137	54
Labour	151	94
Equipment breakdown	143	89

Source: field survey, 2021

The analysis in table 10 shows that 34% are affected by age of cocoa, 63% are affected by Labour while 44% are affected by equipment breakdown.

Table 10: how affected are you by the risks?

Variables	Frequency	Affecting your farm Percentage
Age of cocoa	54	34
Labour	100	63
Equipment breakdown	70	44

Source: field survey, 2021

TO EXAMINE IDENTIFIED PRODUCTION RISK FACTOR ON INCOME GENERATION
Examined drought effect on income generated

From the result analysis in table 11, it explained that drought affects majorly farmers within the income range of 250,001-20,000,000, follows by farmers within the income range of 100,001 to 250,000. The table explains that the higher the gross margin, the higher the risk, it also explains that risks with the highest percentage affects farmers within the highest income range.

Table 11: gross margin and production risks (drought)

DROUGHTS	-1,000,000,000 TO -1	1-150,000	150,001 – 1000,000	100,001 – 250,000	250,001 – 20,000,000	TOTAL
1-15%	16	1	5	18	58	98
16-25%	4	1	2	4	7	18
26-50%	2	0	0	0	2	4
	22	2	7	22	67	**120**

Source: field survey, 2021

Table 12 explains that farmers within the income range of 100,001 to 20,000,000 are mostly affected by price

spikes

Table 12: Gross margin and production risks (price spikes) tabulation

PRICE SPIKES	GROSS MARGIN GROUPING					
	-1,000,000,000 TO -1	1-50,000	50,001 – 100,000	100,001 – 250,000	250,001 – 20,000,000	TOTAL
1-15%	7	0	3	13	23	46
16-25%	5	1	2	8	24	40
75-100%	9	1	3	5	29	47
	21	2	8	26	76	133

Source: field survey, 2021

Table 13 Gross margin and production risks (inconsistent production) tabulation

INCONSISTENT PRODUCTION	GROSS MARGIN GROUPING					
	-1,000,000,000 TO -1	1-50,000	50,001 – 100,000	100,001 – 250,000	250,001 – 20,000,000	TOTAL
1-15%	8	2	7	13	40	70
16-25%	8	0	0	11	33	52
26-50%	1	0	0	2	6	9
	17	2	7	26	79	131

Source: field survey, 2020

Table 14: Gross margin and age of cocoa crosstabulation

Age of Cocoa	GROSS MARGIN GROUPING					
	-1,000,000,000 TO -1	1-50,000	50,001 – 100,000	100,001 – 250,000	250,001 – 20,000,000	TOTAL
1-15%	4	1	2	8	15	30
16-25%	2	0	1	2	14	19
51-75%	1	0	0	1	3	5
	7	1	3	11	32	54

Table 15: Gross margin and equipment breakdown crosstabulation

Equipment Breakdown	GROSS MARGIN GROUPING					
	-1,000,000,000 TO -1	1-50,000	50,001 – 100,000	100,001 – 250,000	250,001 – 20,000,000	TOTAL
1-15%	7	1	2	7	22	39
16-25%	4	0	1	6	11	22
26-50%	1	0	0	2	6	9
	12	1	3	15	39	70

Table 16: Gross margin and labour cross tabulations

Labour	GROSS MARGIN GROUPING					
	-1,000,000,000 TO -1	1-150,000	150,001 – 1000,000	100,001 – 250,000	250,001 – 20,000,000	TOTAL

1-15%	5	0	2	10	43	60
16-25%	8	1	2	6	14	31
26-50%	2	0	0	2	5	9
	15	1	4	18	62	100

Multiple Regression Results

To ascertain factors influencing income generated as a result of the production risk

Multiple regression analysis was carried out to examine the causal factors influencing income generation of cocoa farmers over production risk factors and the respondents' socio-economics variables. The results of this analysis were presented from table 17. The dependent variable is gross margin.

Table 17: Multiple Regression Results table

Dependent variables: Gross Margin

10% significant level, 5% significant level

| Variables | Unstandardized coefficients | | Standardized Coefficients | T | Sig | Correlations | | |
	B	Std. Error	Beta			Zero-order	Partial	Part
Age	22475.231	34369.372	.191	.654	.515	.037	.076	.068
Sex	-14410.372	660809.00	-.003	-.022	.983	-.015	-.003	-.002
Religion	-578612.305	367694.835	-.200	-1.574	.120	-.178	-.180	-.163
Educational attainment	3986.615	150529.882	.004	.026	.979	-.028	.003	.003
Marital status	449209.953	348945.629	.206	1.287	.202	.134	.148	.134
Family size	-154126.987	104249.360	-.313	-1.478	.144	-.087	-.169	-.154
Livelihood secondary sources	-194956.317	624553.866	-.040	-.312	.756	-.044	-.036	-.032
How do you acquire cocoa farmland	-143154.155	149703.601	-.123	-.956	.342	-.063	-.110	-.099
Cocoa farmland size	-133.941	2256.513	-.007	-.059	.953	.014	-.007	-.006
When do you start planting cocoa	319244.855	262724.550	.239	1.215	.228	.028	.140	.126
Source of capital for cocoa farming	397520.502	373367.278	.163	1.065	.290	.029	.123	.111
Amount of loan received	-821319.962	323647.435	-.418	-2.538	.013	-.153	-.283	-.264
Sources of raw material	391975.066	828730.819	.064	.473	.638	.055	.055	.049
Production risks(drought risks 3)	391655.082	462140.327	.102	.847	.399	.008	.098	.088
Production risks (price spikes 3)	81679.181	109347.061	.083	.747	.457	.056	.087	.078
Production risks (inconsistent production) 3	301336.318	262792.929	.132	1.147	.255	.078	.132	.119

Dependent variables: gross margin
Source: computer result

Based on the estimated results, 8 variables are found to have significant influences on farmers' income. These are Religion, Marital Status, Family size, livelihood secondary sources, when you start planting, amount of loan received, production risks(drought), production risks (inconsistent production) respectively. The significant positive signs on marital status implies that there exist a mutual benefits derived in working together as husband and wife, where risks are spread, better decision-making opportunity and larger pool of resources existed for the enhancement of the family which reduces risk, the significant positive signs on when you start planting indicate that planting at appropriate time has an effect on income, the significant positive signs on drought indicate that the higher the drought, the lower the income, this can be subsidize by having irrigation on the farm and also the significant positive signs on inconsistent production [12].

The estimated coefficients of variables livelihood secondary sources, amount of loan received and family size are all negative and significantly different from zero at 10 percent and 5 percent level respectively for regression of profit and loss model. Holding all other factors constant, form of jobs involved in or adopted have a significantly lower probability to improve income compared to those without other sources of income. In addition, Loan amount could decrease the likelihood of engaging in the decision to improve income also family size have a significantly lower probability to improve income.

Table 18: Anova Table

Dependent variables: Gross Margin
10% significant level, 5% significant level
ANOVAa

Model		Sum of squares	df	Mean square	F	Sig.
1.	Regression	4.272E13	16	2.670E12	1.169	.312[b]
	Residual	1.690E14	74	2.283E12		
	Total	2.117E14	90			

Dependent variable: Gross Margin

Table 19: Diagnostic Analysis

Dependent variables: Gross Margin
10% significant level, 5% significant level
Diagnostics

Model	R	R Squared	Adjusted R square	Std. Error of the Estimate	Durbin-Watson
1	0.649	0.520	0.429	1.511	2.216

Dependent variable: Gross margin

Durbin-Watson explains that there is no multi-collinearity between 2 variables i.e no 2 variables explain same thing. Variables are independent, a does not explain b likewise b explain a. The multiple regression model was conducted to investigate factors that influence income generated as a result of production risks estimated via ordinary least square method estimation technique. The table presents the estimated results of the regression model. Table 19 suggests 52% of the explanatory variables explained the dependent variables, 48% factors remained unexplained: there should be further study to explain the unexplained variables.

4. CONCLUSIONS

The study revealed that modal age was in the age-bracket of 35-45 with a mean age mean of 38.8 years. This is an active age group, young and agile that can influence productivity. The study indicated that majority of the farmers are male and are more involved in cocoa farming activities. This is attributed easy access to loans facilities. The study revealed the mean household size of the respondents were 5 persons. Ondo state been a Christian state, majority of the farmers (76.3%) are Christian, (18.8%) are Muslims while (5.0%) are traditional worshippers.

The study deduced that majority of the farmer (26.3%) are illiterate with no educational background. This has hence made to be vulnerable to high production risk. The study further shows that those farmers that had high education were affected by low production risk. Similarly, level of literacy of the cocoa farmers have effect on the farm size and access to loan facilities. The study indicated the relationship between production risks and level of awareness and the degree of effect on cocoa production. The study identified various level of production risks among which are Drought, Price Spike and Inconsistence in productions are the dominant ones. The study revealed that 96.3% of the cocoa farmers were aware and 75% of such farmers indicated the effect of these risks on their cocoa production with various level of degree. Moreover, these identified productions had a huge effect on income generation. This thus explains that the higher the gross margin, the higher the risk, it also explains that risks with the highest percentage affects farmers within the highest income range.

Multiple regression analysis was used to examine factors influencing gross income of cocoa farmers as a result of production risks and other socio-economic variables. The model presents a robust estimate as 52% of the explanatory variables explained the dependent variables while 48% percent remained unexplained. Based on the estimated results, 8 variables are found to have significant influences out of 14 variables considered in the equation to have influenced on farmers' income. The significant positive signs variables implied a positive contribution to dependent variable. The estimated coefficients of variables livelihood secondary sources, amount of loan received and family size are all negative and significantly different from zero at 10 percent and 5 percent level respectively.

The study revealed that modal age was in the age-bracket of 35-45 with a mean age mean of 38.8 years. This is an active age group, young and agile that can influence productivity. The study indicated that majority of the farmers are male and are more involved in cocoa farming activities. This is attributed easy access to loans facilities. The study indicated the relationship between production risks and level of awareness and the degree of effect on cocoa production. The study identified various level of production risks among which are Drought, Price Spike and Inconsistence in productions are the dominant ones. The study revealed that 96.3% of the cocoa farmers were aware and 75% of such farmers indicated the effect of these risks on their cocoa production with various level of degree.

The study indicated that 96.3% of the respondents are aware of drought as a production risk, 96.9% are aware of Price spikes and 100% of the respondents are aware of inconsistent production as production risk respectively. Moreover, these risks are affected by drought (75%) price spikes (83.1%) while 81.9% were affected by inconsistent production. Similarly, 54% of farmers are aware of Age of cocoa as production risk, 94% of farmers are aware of labour as production risk while 89% farmers are aware of equipment breakdown as production risk.

5. RECOMMENDATION
•   Irrigation system should be encouraged to reduce the effect of drought, government should give out grant/funds to encourage farmers to produce low-scale irrigation and training on effective handling.

• Farmers needed more extension program on risk management strategies because even though farmers have an inclusive knowledge about a program, they may not have access to it.

• Loans with low interest rates should be made available to farmers.

• The study deduced that the dominant production risks of drought, price spikes and production inconsistences has mean effect of 66.7% on cocoa production in the study areas. This is significant; hence the study recommends the risk management strategies of crop insurance, access to timely credit facilities, training on the risk management strategies to the cocoa farmers, efficient marketing policy delivery and government to be consistence on their policy on commodities particularly in cocoa marketing and grading and this study found out that these are the most dominant production risk factors confronting cocoa farmers from making commeasurable income from cocoa farming.

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