

## **Determination of Cocoa Farmers' Knowledge on Environmental Hazards Associated with Cocoa Farming Operations in Nigeria**

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**ABSTRACT** The study assessed knowledge level of smallholder cocoa farmers on environmental hazards associated with cocoa farming operations in Nigeria. It specifically determined the correlate between knowledge of environmental hazard and farmers' yield. A multistage sampling procedure was used in selecting 600 respondents from five geo-political zones where cocoa is commercially grown in Nigeria. Results revealed that cocoa farming was dominated by male farmers (94%), literate (81.5%) with a mean age of  $48.6 \pm 14.0$  years and 31.3 percent were members of Cocoa Farmers Association. Majority (68.8%) of the farmers exhibiting fair knowledge of environmental hazards, while following hazards knowledge were revealed among the respondents; social (55.7%), health (54.2%), physical (38.8%), biological (36.7%), chemical (34.7%) and cultural hazards (25%). There was a positive and significant relationship ( $r = .171$ ;  $p < 0.01$ ) between farmers' yield and their knowledge of environmental hazards, this implies that farmers cocoa yield increases as their knowledge on environmental hazards increases.

**Keywords:** Knowledge, Environmental hazards, Cocoa Farming

### **Introduction**

Cocoa was one of the leading crops that placed Nigeria as the 2<sup>nd</sup> leading producer in the world market in the 60s and early 70s (Daramola *et al.*, 2009). But with the advent of petroleum, there was a reduction in the contribution of the crop to the country's economy, as a result of people migrating from rural areas where cocoa is being produced to urban centers to look for white collar jobs, leaving cocoa farming in the hands of aged and less educated farmers. However, the unrest in the Niger Delta, which is the major supplier of petroleum and the increasing population necessitate that Nigeria should revert to Agriculture as an alterna-

tive driving force for the nation's economy.

Hitherto, this has led the Government to come up with Agricultural Transformation Agenda (ATA), a programme designed to rebirth Agriculture, and Cocoa Transformation Agenda (CocTA) a programme to rebirth and increase cocoa production (Federal Ministry of Agriculture and Rural Development, FMRD, 2011). Though Nigeria contributed 11 per cent of the world's 3.5 million tons of cocoa supplied in 2005 (Nzeka, 2005), its benefits and contribution to the country's economy and people's health cannot be overemphasized. In 2002, it contributed 2 per cent to the natural export earning and source of livelihood for 200,000 households, National Cocoa Development Committee (NCDC, 2008), while it contributed \$533.4 million to Nigeria non-oil export earning between January and June, 2011 (Agboola and Ochigbo, 2011). Studies (Cocoa Producer Alliance, COPAL 2007, ICCO, 2008, and NCDC, 2008) have shown that the consumption of cocoa and cocoa products is associated with the following health benefits: reduction of fatigue prevents malaria, diabetes and hypertension.

However, cocoa product like any other agricultural products is confronted with diverse problems which can be attributed to low production and hazards. Attesting to this, Onyenweaku (2000) and Nigeria Institute of Social and Economic Research (NISER)(2001) separately identified technical resource, socio-economic, organization, inadequate economic policies, cultural barriers, ineffective services, and environmental hazards as major problems of farming. In some other separate studies, National Cocoa Development Committee (NCDC, 2008), Asogwa and Dongo (2009), Iremiren (2011) and Cocoa Research Institute of Nigeria (CRIN, 2010) emphasized that abandonment of farms, old age, old farm, pests and diseases were rated as serious factors that are affecting cocoa production.

In an attempt to solve these various problems associated with cocoa production, cocoa farmers engaged in the use of chemicals such as pesticides and fertilizers. Asogwa and Dongo (2009) and Mohit (2008) identified the indiscriminate use of these chemicals among cocoa smallholder farmers as a major problem. This was further buttressed by Siddaramaiah and Srinivas (2010) who reported that commercial agriculture is characterized by indiscriminate use of high doses of chemical fertilizers and pesticides for quick and immediate return in investment which consequently leads to environmental hazards. It was also reported by ICCO (2008) that the indiscriminate use of chemicals leads to residue in cocoa bean which makes them unsafe for human consumption hence, creating environmental hazards. The foregoing has led the European Union (EU) to ban cocoa bean from farmers not conforming to the minimum residue level (MRL) of .01mg (ICCO, 2008).

In the context of this paper, Eteng's (2005) definition of environmental hazard was adopted thus: as pathological effect of various chemicals, physical and biological agents as well as the broad physical and social environment which includes housing, urban development, land use, transportation, industries and agriculture. This definition is accepted based on the fact that it encompasses all aspects of life in relation to agriculture, including some pathological effects (chemical, social, cultural and biological agents) which can lead to health issues. The physical aspect include activities of farmers in cocoa operations such as carrying load, use of sharp objects and transportation effect, comprising smoke from exhaust and noise. Wright and Boorse (2011) described it as having four generic categories; cultural (this involves social relationships of man and its environment, smoking and excessive eating), biological (bacterial, viral and parasitic diseases), physical (effect of equipment on user, climate change and injuries), chemical (use of chemicals, fertilizers and preservatives and by extension these hazards may lead to health hazard. In addition, Scribd (2001) classified social hazard as originating from societal induced and societal made system. Explaining further, that societal in-

duced is the interaction between the society and the natural forces i.e. deforestation or cutting down of trees, while societal made hazard is when the corruption of individual or group in nature infiltrates the ethical and behavioral domain of the society.

Tettey et al., (2009) explained that agricultural operations all over the world are the most hazardous, made up of operations that are hazardous; and cocoa farming is not left behind. Explaining further, they itemized operations such as working with farm tools, carrying loads, trekking, agrochemicals, noise from vibrating heavy equipments, back pain, bending and exposure to insects and animals as hazardous. Famuyiwa (2013) identified forty-five major hazardous practices, such as chewing, answering calls while spraying pesticides, mixing chemicals with bare hands and not wearing protective among others in cocoa operations among smallholder farmers. Tettey *et al.*, further established that most safety and health hazards experienced by West African farmers are due to lack of knowledge and adequate information. This was also corroborated by Asogwa and Dongo (2009) that indiscriminate uses of chemicals by cocoa farmers are as a result of their illiteracy. On the contrary, Uwagboe (2010) discovered in a study that farmers who were trained on Integrated Pests Management (IPM) did not adhere to the practice. This study goes on to support Badcock-walter (2004) who claimed that knowledge does not equal to change. However, Asenso-Okyere and Davis (2009) defined knowledge as organized or processed information or data fundamental to the pursuit of innovation. They also claimed that for knowledge to lead to change, it must be created, accumulated, shared and used. Hence knowledge is important in agricultural transformation.

From the foregoing, it is necessary to assess the level of knowledge of smallholder cocoa farmers on environmental hazards associated with cocoa operations so as to discuss the implications of the risk involved. The study generally assessed the level of knowledge of environmental hazards associated with cocoa farming operations among smallholder farmers in Nigeria. Specifically, it identified the socio-economic characteristics of smallholder cocoa farmers; and determined the knowledge of environmental hazards associated with cocoa operations among the farmers in the study area as well as established the relationship between farmers' knowledge of environmental hazards associated with cocoa farming operations and some socio-economic characteristics.

## Methodology

Onasanya (2009) in a study revealed that 80% of cocoa farmers are smallholder hence, cocoa farmers in Nigeria were considered for the study. A multistage sampling procedure was used in selecting respondents for the study using CRIN geographical information system (GIS) generated land use/ land cover in cocoa farms in Nigeria. Stage one involved purposive selection of five from six geo-political zones where cocoa is commercially grown in Nigeria. Stage two involved purposive selection (based on their production levels; the highest producing state was selected) of one state from each of the five geo-political zones that support commercial production of cocoa, this gives a total number of five states (Ondo, Kogi, Abia, Cross Rivers and Taraba) from the fourteen states. At stage three, selection of two local government Areas (LGAs) which were purposively selected (on their levels of production; the highest and the lowest producing LGAs) from the list of LGAs based on their production level of cocoa to give 10LGAs. Stage four was a random selection of one community from the lists of communities in each LGAs to give 10 communities. While stage five involved systematic se-

lection of 60 smallholder cocoa farmers from the list of cocoa farmers in each community to give 600 smallholders as the respondents for the study. A structured interview schedule was used to elicit information from the respondents while data were analyzed using descriptive and inferential statistical tools.

#### *Development of scale to measure environmental hazards associated with cocoa farming*

Based on exhaustive review of literature (Eteng, 2005; ICCO, 2008; Farinde and Ogunjimi, 2009; Tettey, et al., 2009 and Wright and Boorse, 2010) as well as consultations with research scientists (years of practical experience of nothing less than 15 years working with farmers in different areas of their discipline working with the mandate crop cocoa; as stated below was considered) in CRIN and some cocoa farmers, 55 items related to environmental hazardous practices associated with cocoa farming were generated from which selections were made. Two judges were randomly selected from each of the six research based units (Entomology, Pathology, Soil science, Extension, Economics and Agronomy) in CRIN and 12 cocoa farmers to make 24 judges in all. The selected hazardous practices were subjected to judges rating and items having relevant weight of more than 0.75 were considered for final selection and 45 hazardous practices constituted the scale used in measuring environmental hazards of the farmers.

#### *Grouping of hazardous practices into hazards*

Based on exhaustive review of literature (Eteng, 2005; ICCO, 2008; Farinde and Ogunjimi, 2009; Tettey, et al., 2009 and Wright and Boorse, 2010), six hazards, social, cultural, physical, biological, chemical and health hazards were identified and defined. Based on their definitions, the judges were asked to group the hazardous practices to each of the six hazards and 70 percent occurrence and above were assumed to have very strong relationship occurrence based on Davis descriptor as explained by Subair (2007). Each of the respondents scores on the hazardous practices were allotted to the relevant hazards. The maximum knowledge score of a respondent to each hazard was 1 while the minimum score was 0. Hence, each hazardous knowledge of practice could score a maximum of 600 and a minimum score of 0. The total attainable knowledge score for all of the hazardous practices was 27, 000 while the minimum was 0. On the other hand, the knowledge level of the smallholder farmers on environmental hazards associated with cocoa farming operation was measured, using mean  $\pm$  standard deviation according to the rule of thumb. The maximum knowledge score to each hazardous practice was 1 and a minimum score of 0. Each farmer could score a maximum of 45 and a minimum of 0. The total knowledge score per farmer was further classified to three levels of high knowledge, fair knowledge and low knowledge using mean  $\pm$  standard deviation. The mean score was 28.9 with a standard deviation of 14.6. Hence, farmers having scores  $\geq 43.5$  were considered to be in the high knowledge group, scores less  $\leq 14.3$  were considered to be in the low knowledge group while scores between  $\geq 14.3$  and  $\leq 43.3$  were in the fair knowledge group.

## **Results and Discussion**

#### *Socio-economic characteristics of cocoa farmers*

Results in Table 1 revealed that mean age of the farmers was  $48.6 \pm 14.0$  years with majority

(83.1%) between 20 and 60 years of age. This report supports the finding of Uwagboe (2010) that the cocoa farmers mean age was 50 years. However, in earlier study, Opeke (2005) reported that mean age among cocoa farmers was as high as 70 years. It shows that more young people are entering cocoa farming which may be a means of solving the old age problem in the enterprise. Majority (94%) of cocoa farmers were male, which corroborate Oluyole and Sanusi (2009)'s finding that 92 per cent of cocoa farmers were male, an indication that cocoa farming is still dominated by male farmers. This can be attributed to the claims of Oladipupo (2010) that distribution in farm work is skewed towards the male gender as a result of gender inequalities. Olabisi (2008) opined that performance of more male in farming is due to gender stereotype which can be as a result of men decisiveness, aggressiveness and ambition.

#### *Cocoa farmers' years of farming experience*

Results in Table 1 showed that the farmers were well experienced with a mean age of  $24 \pm 14.9$  years. About 32.4 per cent had between 11 and 20 years, 23.2 per cent between 21 and 30 years, 19.6 per cent between 10 and 20 years, 11.5 per cent between 31 and 40 years while 13.1 per cent had more than 41 years of farming experience. This report supports the findings of Lawal and Sanusi (2010) in a study of cocoa farmers in Ondo and Kwara States and Uwagboe (2010) in a study of cocoa farmers in Edo State, that most cocoa farmer in Nigeria have more than 20 years of farming experience. Although experience is defined by Marriam-Webster (2000) as collection of events and or activities from which an individual or group may gather knowledge, however, long experience in farming can only be appreciated if put into practice.

#### *Farm size of the farmers*

Data in Table 1 showed the distribution of cocoa farmers according to their farm size in Ha. The data revealed that majority (74.7%) of the farmers had between 0.5 and 10 Ha, 14.3 percent between 11 and 20 Ha, 6.2 percent between 21 and 30 ha, 0.8 cultivated between 31 and 40 Ha, while 4.0 percent cultivated above 40 Ha. The mean farm size in the study area was 10.4Ha with standard deviation of 2.0. The finding supports the study of Oluyole and Sanusi (2010) in a study of cocoa farmers in Cross Rivers State of Nigeria.

#### *Age of farm*

Data in Table 1 showed (in the appendices) that respondents mean farm age was 32.3 years and standard deviation 2.2 years. Very few (18%) had farm equal or less than 10 years of age. About 48.67% of the respondents' farms were under productive age of 30 years, while about half (51.3%) of the respondents cultivated farms that were more than 30 years old. This implies that cocoa farms were old. This is an indication that most farms are not at their active pick production. This might have led to moribund and low production in some of the farms. Consequently, farmers may engage in the use of chemicals to increase their yield. This was supported by Siddaramaiah and Srinivas (2010) and this corroborates the findings of Asogwa (2008), CRIN (2010), Ogunjimi and Farinde (2010) and Oduwole (2011) that reported in different studies that cocoa production in Nigeria has been affected by the old age of the farms.

*Cocoa farmers' Level of Education*

Data in Figure 1 revealed that about 18.5 percent of the smallholder cocoa farmers did not have formal education, while 81.5 percent had one level of education or the other. Though majority (81.5 %) were literate, being able to read and write, but their level of education was still low as only 16.3 percent and 5.5 percent were able to complete secondary and post secondary education respectively. However, ability to read, write and understand instructional manuals of chemicals and some literature on environmental hazards preventive measures might help in risk aversion, through increase in knowledge.

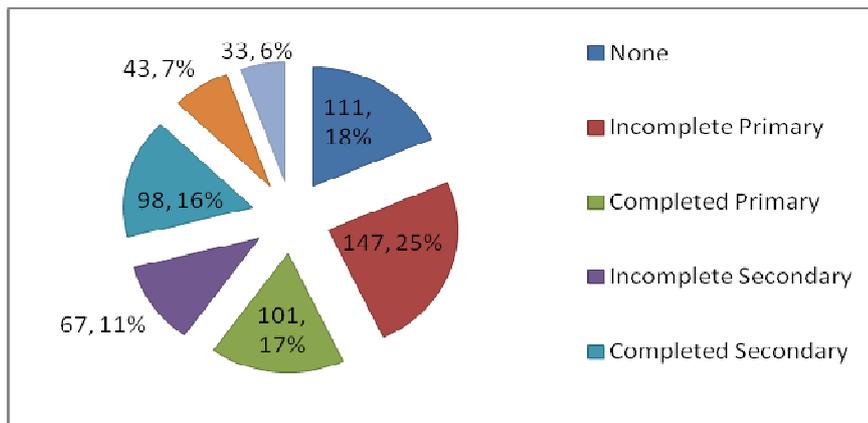


Figure 1: Cocoa farmers' educational level

*Membership in cocoa organization by farmers*

Data in Figure 2 revealed that majority (68.7%) of the respondents did not belong to any cocoa organization, while only 31.3 per cent belonged to one cocoa organization or the other. It further revealed that 16% belonged to Cocoa Association of Nigeria, while 15.3% belonged to some other local cooperative groups. Oduwole (2011) opined that one major benefit of belonging to organization is the share of knowledge on innovation; such as approved pesticides and chemicals, government policies and more importantly in the areas of innovation platform where seminars and demonstration are being carried out.

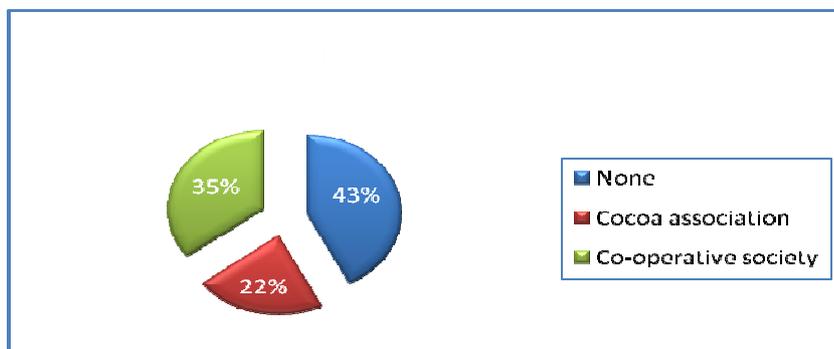


Figure 2: Cocoa farmers' membership of organization  
Cocoa farmers' sources of information

Data in Figure 3 revealed that input dealers (70%), Friends and Neighbours (60%) and Radio/Television (50%) were the most frequent sources of information by cocoa farmers. Other sources of information were other Association (45%), Newspaper (35%), Government agencies (30%), Cocoa association (25%) while Research Institute and Extension Agent/Agency were (20%) each. This result implies that sources of information on issues of environmental hazards to the respondents were not from approved sources. This study corroborates Uwagboe (2010) that 70% of farmers studied in Edo State sourced their information from cocoa chemical dealers. The result also implies that farmers may be more exposed to environmental hazards due to their sources of information. Information is the pivot to knowledge, according to Asenso-Okyere and Davis (2009) who defined knowledge as processed information. However, the sources of information are also germane considering the qualities of knowledge the information has to generate. Information generated from input dealers might be defective because they are always out to maximize their profit and sell their product, while those generated through friends and neighbours might be inaccurate. The recommended and classified sources of information; such as Research Institute and extension agents were less patronized by farmers. The knowledge acquired from their sources of information might be defective and low as majority depended on input dealers as well as friends and neighbours.

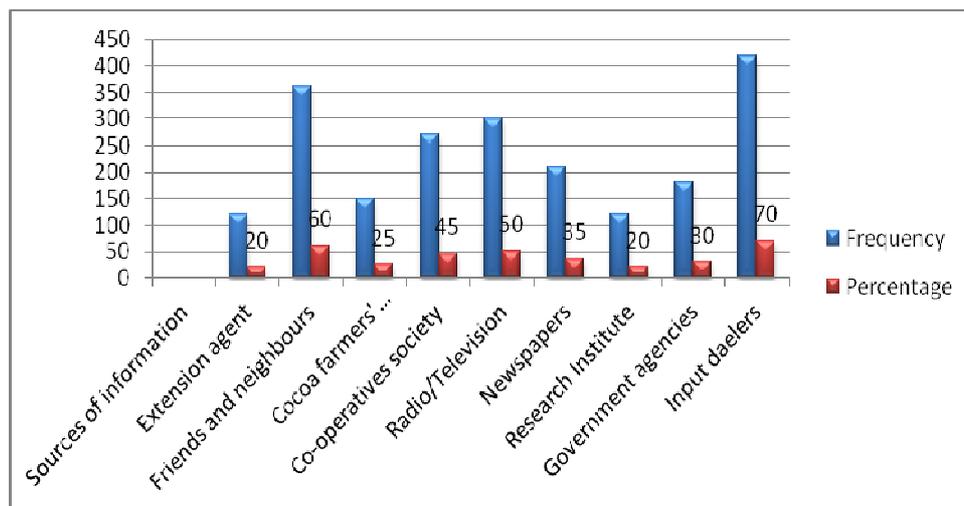


Figure 3: Cocoa farmers' sources of information

*Farmers' knowledge of environmental hazards associated with cocoa operations*

Result in Table 2 showed that knowledge of environmental hazard in the study area was generally low with the highest been 55.7% in social hazard and the least 25.02% in cultural hazard. Others were health (54.2%), physical (50.2%), biological (36.7%), and chemical (34.7%), respectively. This may be based on their belief; that some hazardous practices such as child labour be considered as socialization and not social or cultural hazards. While some farmers belief that greetings such as attendance to calls or exchange of pleasantries during pesticides applications are not hazardous. Furthermore, report in Table 3 (in the appendices) showed that majority (68.8%) belonged to the fair knowledge level category while only 10%

belonged to the high knowledge level category. These findings corroborated Ogunjimi and Farinde (2010) in a study carried out in Osun and Edo States that cocoa farmer had a low knowledge of precautionary measures of environmental hazards. Similarly, Uwagboe (2010) also identified that 70% of trained cocoa farmers on IPM did not practice the technique. The implication of this is that only knowledge created, accumulated, shared, used and valued could lead to risk aversion. Farmers use chemicals indiscriminately, targeting the returns on yield in respective of the danger the resulting yield may cause. Asenso-Okyere and Davis (2009) explained that proper articulation of innovation was as a result of knowledge created, accumulated, shared, used and valued. Individual knowledge of hazard and practice of precautionary measures would go a long way in reducing vulnerability to environmental hazards. This implies that cocoa farmers in the study area had fair knowledge of environmental hazards associated with cocoa farming operations and is consequential to vulnerability of stakeholders along cocoa value chain to hazards.

*Correlation analysis of knowledge of associated environmental hazards and socio-economic characteristics of cocoa farmers*

Table 4 revealed (in the appendices) that at 0.01 significant level, there were positive and significant relationship between knowledge of environmental hazards associated with cocoa farming operations and age of farmers ( $r=0.081$ ), years of farming experience ( $r=0.025$ ), farm age ( $r=0.104$ ), farm size ( $r=0.085$ ), yield ( $r=0.171$ ) and adoption of hazards preventive measures ( $r=0.128$ ). The implication is that the null hypothesis is rejected, as knowledge of farmers in environmental hazards associated with cocoa increases, there were increase in age of farmers, years of experience, farm age, farm size, yield, and adoption of environmental hazards preventive measures. The finding is supported by Badcock–walter *et al.* (2004) that key antecedents of behavioral change are knowledge, attitude and belief. It shows that knowledge of smallholder cocoa farmers on environmental hazards associated with cocoa farming operation is important to increase their cocoa yield. However, Table 4 also revealed that the  $r^2$  tested were very low, indicating that they had low strength of relationships, this might be as a result of the farmers' low knowledge in environmental hazardous practices associated with cocoa operations which is evident in their yield.

### **Implications of the study to police and practice**

The study found that cocoa farmers throughout the geo-political zones did not belong to cocoa production association. This implies that cocoa farmers would be missing the chance of socialization in cocoa production through group interactions and exchange of ideas. This may be one of the reasons for low knowledge level in cocoa chemicals. It is therefore essential that cocoa farmers be encouraged to join cocoa farmers group or innovation platform were market or more pressing issues can be resolved. This will also enable the Government to meet them either for training or technological information dissemination and government law will be easily enforced. Agricultural extension contact was low among the farmers, thus they seek information from the retailers who may not provide the right information. This also calls for setting up of an active agricultural extension agency that would oversee technological information among cocoa farmers. Policy need to be established to control purchase and usage of chemicals for agricultural safety.

### **Conclusion and Recommendation**

In conclusion, cocoa farmers in Nigeria are still within the production age, majority are male with high experience in cocoa farming operations but with low knowledge in environmental hazards associated with cocoa farming operations. There is still the need to intensify on improving farmers' knowledge on hazardous practices and encourage the adoption of environmental hazards preventive measures. More so, the study gave an insight into the extent of vulnerability of stakeholders in cocoa value chain to environmental hazards. This is more evident as knowledge of hazards associated with cocoa farming operations is low among the farmers. By extension, it can be deduced that farmers are always more concern with their immediate gain other than going through pre-cautionary measures.

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**Table 1:** Distribution of respondents by their socio-economic characteristics

S/N	Variables	Frequency	Percentage	Mean	Std
	<b>Age</b>			48.57	14.08
	20-40	221	36.9		
	41-60	277	46.2		
	61-80	90	15.1		
	81-100	12	2		
	<b>Sex</b>				
	Male	564	94		
	Female	36	6		
	<b>Years of Farming Experience</b>				
	10 - 12years	118	19.6	24	14.9
	11 - 20years	195	32.4		
	21 - 30years	139	23.2		
	31 - 40years	69	11.5		
	41 - 50years	49	8.1		
	51 - 60years	25	4.2		
	> 60years	5	0.8		
	<b>Farm Size</b>				
	0.5 - 10 ha	448	74.7	10.4	2.0
	11 - 20 ha	86	14.3		
	21 - 30 ha	37	6.2		
	31 - 40 ha	5	0.8		
	> 40 ha	24	4		
	<b>Age of Farm</b>				
	<10	108	18	32.3	2.2
	11 - 20 years	109	18.2		
	21 - 30 years	75	12.5		
	31 - 40 years	122	20.3		
	41 - 50 years	107	17.8		
	51 - 60 years	50	8.3		
	61 - 70 years	9	1.5		
	> 70 years	20	3.3		

Source: Field survey, 2012

Table 2: Distribution of respondents' knowledge of environmental hazards associated with cocoa farming in percentage.

Zones	State	Environmental hazards*					
		Social	Cultural	Physical	Biological	Chemical	Health
Southwest	Ondo	53.93	<b>32.13</b>	<b>29.02</b>	33.85	37.69	<b>42.80</b>
North	Kogi	62.07	27.20	45.37	43.30	38.04	63.28
Central	Abia	<b>41.93</b>	<b>15.13</b>	31.02	<b>25.85</b>	<b>25.69</b>	<b>42.80</b>
South	Cross	52.30	21.89	38.28	33.96	30.81	52.13
South	Rivers	<b>68.15</b>	28.74	<b>50.19</b>	<b>46.26</b>	<b>41.02</b>	<b>69.80</b>
North	Taraba	55.68	25.02	38.78	36.64	34.65	54.16
East							
Total	Study Area						

Source: Field survey, 2012; \*Multiple responses

TABLE 3: Farmers' knowledge of environmental hazards associated with cocoa production

Knowledge level	Scores	Frequency	Percentage
High Knowledge	> 43.5	60	10
Fair Knowledge	≥ 14.3 ≤43.5	413	68.8
Low knowledge	<14.3	127	21.2

Source: Field survey, 2012

Mean = 28.9

Standard deviation = 14.6

Maximum score = 45.

Minimum score = 0.0

N = 600

Table4: Correlation analysis showing relationship between cocoa farmers' knowledge and environmental hazards associated with cocoa operations N = 600

Variables	Pearson correlation Coefficient(r)	Coefficient of Determination r <sup>2</sup>
Age of farmers	0.081	0.007
Years spent in education	0.110	0.012
Years of farming experience	0.025	0.001
Farm age	0.104	0.011
Farm size	0.085	0.007
Yield	0.171	0.029
Adoption of hazards preventive measure	0.128	0.016

Source: Field survey, 2012; Level of significance – Significant at 0.01 level