Effect of farmers' socio-economic characteristics on knowledge of Environmental Hazards Associated with Cocoa Farming Operations in Nigeria

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Abstract: This study aimed at determining relationship between farmers' socio-economic characteristics and knowledge of environmental hazards associated with cocoa farming operations in Nigeria. A multistage sampling procedure was used in selecting 600 respondents from five geo-political zones where cocoa is commercially grown in Nigeria, while a pretested interview schedule was used to elicit information. Results revealed that cocoa farming was dominated by male farmers (94%), literate (81.5%) with a mean age of 48.6±14.0 years and 31.3 per cent were members of Cocoa Farmers Association. The farmers operate on an average farm size of 10.4±2ha with an average age of 30.3±2.2years. The study also revealed that the farmers are well experienced with an average of 24±14.9 years in cocoa farming. An average yield of 218.8±10kg/ha was indicated with majority (68.8%) of the farmers exhibiting fair knowledge of environmental hazards associated with cocoa farming operations. It also revealed that there were positive and significant relationship between age of famers ($r= 0.08$; $p< 0.01$), years spent in institution ($r=.11$; $p< 0.01$), farming experience ($r= 0.03$; $p< 0.01$), farm size ($r= 0.09$; $p< 0.01$), farm age($r= 0.10$; $p< 0.01$), yield ($r= 17$; $p< 0.01$), seminar ($r=.24$; $p< 0.05$) and extension contact ($r=.14$; $p< 0.05$) and their knowledge of associated environmental hazards. It was concluded that relationship existed between farmers' socio-economic characteristics and knowledge of environmental hazards associated with cocoa farming operations.
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Introduction

Cocoa is one of the main contributors to the Non-oil sector in Nigeria economy. It contributes 2% of the nation's export earnings and over 200,000 households in 14 cocoa producing states earn their living from cocoa cultivation (National Cocoa Development Committee NCDC, 2010). Its contribution is next to crude oil, while it gives Nigeria the 4th position in the world market with a production of about 250,000 MT (International Cocoa Organization, ICCO, 2010). It was reported by Minister of Industry, Trade and Commerce, Mr. Olutoyin Aganga (2012-2015), that cocoa is 2nd largest foreign exchange earner after crude oil and generates two million jobs along its value chain. It was noted that cocoa export and cocoa products have grown over the years by an average of 40% per annum with a cumulative percentage of 280% between 2006 and 2012 from $215 million to $822.8 million respectively while in 2012, Nigeria realized $900 million from export of cocoa and cocoa products (Nairaland, 2013).

Apart from the tremendous potential contributions to the economy, cocoa bean consumption is very important in the health sector. Lots of discoveries through research (COPAL, 2007 and ICCO, 2010) reported separately that consumption of cocoa bean and cocoa products reduce fatigue, prevent malaria, diabetes and hypertension among others.

However, production of cocoa in Nigeria has being facing problems such as pest and diseases, depleting soil nutrient, aged farms and aged farmers. Attempts to reduce the problems and increase production have led into indiscriminate use of chemicals. Asogwa and Dongo (2009) reported that out of 125,000 – 130, 000 MT of pesticides used yearly in Nigeria, cocoa pesticides accounted for 31% (fungicides 65% and insecticides 35%). Mohit (2008) also emphasized that the Federal government should make concerted efforts in retrieving banned pesticides in possession of cocoa farmers and discourage usage.

It was reported in different studies that the indiscriminate use of chemicals by cocoa farmers' are attributable to their socio-economic characteristics. Famuyiwa *et al*., (2013) established a knowledge gap between knowledge of environmental hazards associated with cocoa farming operations and farmers practice of hazards. Uwagboe (2010) identified that those trained on Integrated Pest Management (IPM) did not make use of IPM. Asogwa and Dongo (2009) reported it was due to illiteracy while Siddaramaiah and Srinivas (2010) opined that commercial agriculture is characterized with indiscriminate use of high doses of chemicals for quick and immediate

return on investment without recourse to hazards involved.

Foregoing necessitate the study of socio-economic characteristics on knowledge of cocoa farmers on environmental hazards associated with cocoa farming operations. The premise is based on knowledge gap hypothesis, as described by Wkipedia, (2013); that ‘‘as the infusion of mass media information into a social system increases, higher socio-economic status segments tend to acquire this information faster than lower socio-economic status population segments so that the gap in knowledge between the two tends to increase rather than decrease’’ (Wikipedia, 2013).

Objectives

The main objective is to assess the effect of socio-economic characteristics of cocoa farmers on knowledge of environmental hazard associated with cocoa farming operations.

1. describe the socio-economic characteristics of farmers in the study area.
2. Assess farmers’ knowledge level of environmental hazards associated with cocoa farming operations.
3. Determine socio-economic factors affecting farmers knowledge level of environmental hazards associated with cocoa farming operations.

Hypothesis

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There is no significant relationship between farmers knowledge of environmental hazards associated with cocoa farming operations and their socio-economic characteristics.

Methodology

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 10 LGAs. 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 selection 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 farmers’ knowledge of environmental hazardous practices associated with cocoa farming operations

Based on exhaustive review of literature (Eteng, 2005; ICCO, 2008; Tettey, *et al*., 2009 Wright and Boorse, 2010 and Ogunjimi and Farinde, 2012;) as well as consultations with research scientists with more than 15 years of working experience 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 (Table 7 constituted the scale used in measuring environmental hazards of the farmers. 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 ± standard deviation according to the rule of thumb. 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 ± standard deviation. The mean score was 28.9 with a standard deviation of 14.6. Hence, farmers having scores > 43.5 were considered to be in the high knowledge group, scores less < 14.3 were considered to be in the low knowledge group while scores between 14.3 and 43.5 were in the fair knowledge group. Furthermore, the socio-economic characteristics were subjected to factor analysis using Principal component analysis. Seven factors were extracted based on Verimax rotated factor with Kaiser Normalization.

Results and discussion

Results in Table 1 revealed that mean age of the farmers was 48.6±14.0 years with majority (83.1%) between 20 and 60 years of age also indicated that farmers were well experienced with a mean age of 24±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.

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. So also Table 1 showed 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.

It was 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, 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.

Table 2 shows that majority (68.8%) of the farmers' had fair knowledge level of environmental hazards associated with cocoa farming operations, while only 10% had high knowledge and 21.2% had low knowledge level. Asenso-Okyere and Davis (2009) defined knowledge as organized or processed information or data fundamental to the pursuit of innovation. It implies that farmers in the study area lack organized or processed information on the use of chemicals hence, engage in indiscriminate usage which was supported by Asogwa and Dongo (2009) attributing the indiscriminate use of chemical to illiteracy level of farmers. 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.

Correlate of socio-economic characteristics and knowledge of environmental hazards associated with coca farming operations

Table 3 revealed 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 null hypothesis is rejected. The chi square test in Table 4 showed positive and significant relationships between farmers' knowledge and sex (χ^2 =464.64) marital status (χ^2 =1405.78) religion (χ^2 =1433.61) membership in cocoa group (χ^2 =19.44) membership in cooperative (χ^2 =83.63) level of education (χ^2 =292.35) at $p < 0.05$.

This indicate that attitudinal factors influenced by gender, marital status, association with other farmers, cooperatives and religious affiliation to a significant level affects farmers knowledge and adoption of preventive measures towards environmental hazards in their cocoa farm. 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 3 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 farming operations which is evident in their yield.

Chi square test of some socio-economic factors influencing farmers' knowledge of environmental hazards associated with cocoa farming operations in Nigeria

Table 4 shows that at $p<0.05$, the chi square test of relationship between farmers' knowledge of hazardous practices in cocoa farming practices and socio-economic characteristics. From the variables tested, the $\chi^2_{calculated}$ were higher than $\chi^2_{tabulated}$ hence the decision was rejected. This implies that Sex, marital status, religion, membership in cocoa group, membership in cooperative and level of education have significant and positive effect on farmers' knowledge of environmental hazards associated with cocoa farming operations.

Table 5 shows the results of the component factors extraction among cocoa farmers, by a principal component analysis. Eight factors were extracted namely: external orientation, production, experience, educational, gender, knowledge, headship and religion; based on the tested variables. The extraction was based on factors with Eigen value (E) greater than 1.0, according to the rule of thumb. The Eigen value of each factors' and their variance are shown in Table 5.

The result shows that only 7 out of eight factors with Eigen were greater than 1.0 as shown in Table 5, representing 61.7% of the variance in the data were strong factors that affected the knowledge level of

farmers on environmental hazards associated with cocoa farming operations in Nigeria. However, it is also shown that 3 factors: external orientation (E=2.96), production (E=2.36) and experience (E=2.24) ranked high followed by educational factor with (E=1.65). Table 6 shows the loaded variables based on varimax loading at a coefficient ≥ 0.7 as stated by Davis descriptor in Subair (2007), as variables having very strong relationship. All the variables extracted showed positive coefficient meaning that increase in any factor will increase farmers' knowledge.

External orientation

External orientation represents variables that show extent to which the respondents were exposed to information and interaction in groups and outside group. The factor is made up of three variables; membership in cocoa farmers' association (r=0.87), how long spent in the group (r=0.76) and membership in other cooperatives (r=0.71). It shows that as these variables increase, knowledge level of farmers on environmental hazards associated with cocoa farming operations increase. External orientation affects farmer's attitude towards acceptance of new innovation. 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.

Production factor

The data in Table 6 shows that 3 variables loaded as production factors which were; total yield (r=0.95), average income (r=0.95) and size of farm (r=0.72). Farmers increased knowledge on innovation will increase farm yield and farmers income which will further motivate the farmer to increase the farm size.

Experience factor

Two variables; years of farming experience (r=0.79) and age of farm (r=0.74) contributed positively and significantly to experience as a factor influencing farmers' knowledge level on environmental hazards associated with cocoa farming operations in the study area. Experience and knowledge increases with age and work. With increased experience on environmental hazard in cocoa farming the farmer will adopt measures that reduce the hazards. Wikipedia (2013) stated that 'Experience comprises knowledge of or skill of something or some event gained through involvement in or exposure to that thing or event'. It shows that experience and knowledge are positive and significantly related; which means increase in experience will increase knowledge.

Educational factor

Table 6 shows 2 variables; years spent in educational institution (r=0.83) and level of education (r=0.83) attributing to education as a factor in farmers knowledge level. Table 6 shows there were positive and significant contributions of years spent in educational institution and level of education to farmers' knowledge As level of education and years spent in schooling increases there is increased knowledge through increased exposition to new ideas and innovation.

Gender factor

Gender factor was identified with two variables; sex (r=0.84) and marital status (r=0.80). Gender factor plays a prominent role in decision making in the family household and adoption of preventive measures on environmental factors that can affect farmers' household income.

Headship

The headship in farm household was operationalised as male or female headed. Table 6 shows household headship as a single variable contributing to the factor of headship influencing farmers' knowledge level. With r= 0.742, it indicated that headship was a positive and significant factor in determination of knowledge level of environmental hazards associated with cocoa farming in the study area. This may be due to gender inequalities as claimed by Oladipupo, *et al* (2010) and Olabisi (2008) that further claimed that performance of male in farming is as a result of men decisiveness, aggressiveness and ambition. However, the study area practices patriarchal system of family, making it easier for the families to be headed by male.

Knowledge

Table 6 also shows high positive and significant relationship as r=0.819. However, Table 2 also indicates that farmers' level of knowledge of environmental hazards associated with cocoa farming operations in Nigeria is low, with about 90% in the classifications between fair and low. Appendix B Table 8, also shows various percentages of respondents' knowledge in categories of environmental hazards (Famuyiwa, *et al,* 2013). From Table 8, it is indicated, judging from the total study area that the percentage mean knowledge of respondents in environmental hazard was generally low with the highest been 55.68% in social hazard while the least was 25.02% in cultural hazards.

Implications for changing rural social organization for agricultural development

From the findings, knowledge has been deduced to be an important factor in influencing some socio-economic characteristics of farmers in Nigeria. To change rural social organizations, structures, and institutions for a sustainable agricultural development in Sub-Saharan Africa, the knowledge and socio-

economic characteristics of farmers are very germane. Asenso-Okyere and Davis (2009) opined that knowledge is organized or processed information that lead to change and change does not come until knowledge is created, accumulated, shared and used.

Hence, increasing farmers' knowledge on need for change in rural social organization, structures and institutions will bring about sustainable agricultural development in Sub-Saharan Africa.

Conclusion and recommendation

In conclusion, socio-economic characteristics of farmers have positive and significant relationship with knowledge levels among cocoa farmers in Nigeria. There is still the need to intensify on improving farmers' knowledge on hazardous practices and encourage the adoption of environmental hazards preventive measures. It is hereby recommended that awareness creation on the hazardous practices among farmers through sensitization should be pursued by CRIN and extension agencies. The government agencies and all stakeholders involved in cocoa purchase should also enforce a premium to be paid for farmers who present quality cocoa bean that attain Minimum Residue Level.

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

S/N	Variables	Frequency	Percentage	Mean	Std
	Age (years)			48.57	14.08
	20-40	221	36.9		
	41-60	277	46.2		
	>60	102	17.1		
	Sex				
	Male	564	94		
	Female	36	6		
	Years of Farming Experience				
	<21	313	52.2	24	14.9
	21 - 40	208	34.7		
	41 - 60	74	12.3		
	>60	5	.8		
	Farm Size (ha)				
	0.5 - 10	448	74.7	10.4	2.0
	11 - 20	86	14.3		
	21 - 30	37	6.2		
	31 - 40	5	0.8		
	> 40	24	4		
	Age of Farm (Years)				
	<21	217	36.2	32.3	2.2
	21 - 40	197	32.8		
	41 - 60	157	26.2		
	➢ 60 years	29	4.8		

Source: Field survey, 2012

TABLE 2: Farmers' Knowledge Levels 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

Table 3: Correlation analysis showing relationship between cocoa farmers' Socio-economic and knowledge of environmental hazards associated with cocoa farming operations n = 600

Socio-economic Variables	Pearson correlation Coefficient (r)	Coefficient of Determination (r^2)
Age of farmers	0.08	0.007
Years spent in education	0.11	0.012
Years of farming experience	0.03	0.001
Farm age	0.10	0.011
Farm size	0.09	0.007
Yield	0.17	0.029
Seminar attendance	0.24	0.058
Extension contact	0.14	0.020

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

Table 4: Chi square test of relationship between farmers' knowledge and some socio-economic characteristics

S/N	Variables	χ^2_{cal}	χ^2_{tab}	df	decision
1	Sex	464.64	3.84	1	Significant
2	Marital status	1405.78	9.49	4	Significant
3	Religion	1433.61	7.82	3	Significant
4	Membership in cocoa group	19.44	3.84	1	Significant
5	Membership in cooperative	83.63	3.84	1	Significant
6	Level of education	292.35	15.51	8	Significant

Source: Field survey, 2012
P <0.05

Table 5: Extraction of component factors using Principal component analysis

Component factors	Initial Eigen values		
	Total	% of Variance	Cumulative %
1External orientation	2.957	14.079	14.079
2 Production	2.358	11.230	25.308
3 Experience	2.235	10.642	35.950
4Education	1.651	7.864	43.814
5 Gender	1.404	6.686	50.500
6 Knowledge	1.234	5.875	56.375
7 Headship	1.118	5.325	61.700
8Religion	.981	4.673	66.373

Source: Field Survey, 2012

Table 6: Varimax rotated factor component with Kaiser Normalization

Component matrix								
	1	2	3	4	5	6	7	8
Variables	External orientation	Production	Experience	Educational	Gender	Knowledge	Headship	Religion
Membership in Cocoa organization	.872							
How long have you spent in the group?	.758							
Membership of organization cooperative	.715							
Which position did you hold?	.706							
Yield of cocoa		.953						
Average income		.953						
Size of farm		.722						
Years of farming experience			.785					
Age of farm			.737					
Years spent in educational Institution				.830				
Level of education				.828				
Sex					.836			
Marital status					.796			
knowledge						.819		
Household headship							.742	
Religion								.850

Source: Field Survey, 2012

Apendix A

Table 7: Showing environmental hazards associated with cocoa farming operations

s/n	**Environmental hazards**
A	**Chemical/Biological hazards**
1	The use of fertilizer/chemical not recommended for cocoa production
2	The use of fertilizer/chemical not in the list of approved/banned agrochemical
3	Any chemical that has indicator containing compound such as linden
4	Application of fertilizer/chemical without prior test of soil/plant
5	Over dosage use of fertilizer/chemical
6	Mixing of fertilizer/chemicals as single dose
7	Use of expired fertilizer/chemical
8	Use of unwashed containers for chemical application
9	Deposits of sweating from fermented cocoa bean
10	Pod waste deposits as heap around farm area
11	Pollution from fumes and unhygienic environment
12	Spraying of chemical against the wind
13	Drinking untreated water
	Physical/Cultural
14	Not using Jungle boots during spraying
15	Not using Overall/Protective
16	Not using protective glasses
17	Not using Hand gloves
18	Not using nose protector
19	Exposure to excessive heat or cold
20	Slashing, weeding and cutting of tree
21	Haulage of heavy materials on back or head
22	Usage of sharp objects
23	Bites from snakes, scorpions, aphids, wasp etc
	Social hazards
24	Use of child labour
25	Lack of knowledge on approved chemical
26	Lack of knowledge on banned chemical
27	Not going for medical check-up
28	Indiscriminate disposal of bad cocoa beans
29	Indiscriminate disposal of used chemical containers
30	Not washing of hands after chemical application
31	Talking during application of chemicals
32	Receiving calls during application of chemical
33	Receiving visitors during application of chemical
34	Singing during application of chemical
35	Chewing during application of chemical
36	drinking during application of chemical
37	Whistling during application of chemical
38	Smoking during application of chemical
39	Eating during application of chemical
40	Snuffing during application of chemical
41	Scooping/stirring chemical with bare hands
42	Not attending crop association meetings
43	Not reading chemical instruction before usage
44	Taking advice from retailers
45	Indiscriminate disposal of unused chemicals

Appendix B

Table 8. Distribution of respondents' knowledge of environmental hazards associated with cocoa Farming practices in percentage.

Zones	**State**	**Environmental hazards***					
		Social	Cultural	Physical	Biological	Chemical	Health
Southwest	Ondo	53.93	32.13	29.02	33.85	37.69	42.8
North Central	Kogi	62.07	27.2	45.37	43.3	38.04	63.28
South East	Abia	**41.93**	15.13	31.02	25.85	25.69	42.8
South South	Cross River	52.3	21.89	38.28	33.96	30.81	52.13
North East	Taraba	**68.15**	28.74	50.19	46.26	41.02	**69.8**
Total (Mean)	Study Area	**55.68**	**25.02**	38.78	36.64	34.65	54.16

Source: Famuyiwa *et al,* 2013 (*International Journal of Knowledge, Innovation and Entrepreneurship Volume 1 Nos. 1– 2, 2013, pp. 58—70)*

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