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Determinants of Adoption of Improved Technologies by Small Scale Rubber Farmers in EDO State, Nigeria

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Abstract- The study assessed the response of rubber farmers to the adoption of improved technologies and determine variables affecting the adoption decisions of the respondents. Data were obtained from 137 rubber farmers sampled from the three Local Government Areas (Ovia North-East, Ovia South-West and Uhunmwode) producing rubber in Edo state. Factors that influence the adoption of rubber technology were evaluated using multiple regression analysis which where four functional forms (Linear, Semi-log, Exponential and Cobb-Douglas). 44.5% of the respondents had a monthly income of more than N20,000. Technologies mostly adopted were weeding (100%), fire trace (94%) and pruning (53%). The respondents' educational qualification was mainly post primary (52.6%) and primary (25.5%) education respectively; With Majority of the respondents having a household size 9-12 (45.3%) . The result indicated that the extension contact was very poor. Only 18.2% of the respondents received extension contact and this led to very poor awereness that eventually brought low yield. 83.8% variation in the regress and adoption of rubber technology was explained by the regressors. Similarly, the F value was statistically significant at 5% probability level indicating model fitness. The study therefore recommends that: Rubber Research Institute of Nigeria (RRIN) should improve on the extension delivery by collaborate with relevant government agencies and non-governmental organizations to give regular training to rubber farmers and improved Extension delivery as required to improve farmers' level of awareness and improvement of their production capacity.

KEYWORDS: Farm Technology, Adoption Decision, Rubber farmers, Extension Contact, Small holder farmers, Innovation.

INTRODUCTION

Background to the study

Rubber (*Hevea brasiliensis*) is a perennial dicotyledonous plant, which belongs to the family, Banmeke *et al* 2009 *Euphorbiaceae* and grown commercially over millions of hectares. Rubber was discovered by Columbus and later by Spanish explorers during the 15th and 16th centuries in the Amazon jungles of South America. One of the first uses was to 'rub' out graphite or charcoal marks on paper and parchment, an important use at that time and one which gave the mysterious substance the name by which it is now known as rubber (Banmeke *et al,* 2009).

Nigeria was among the World's leading rubber producers before the oil boom in the 1960's. Nigeria was the biggest producer of natural rubber in Africa and ranked sixth in the world, contributing about 3 percent of the world output between 1957 and 1960 (Agwu, 2006). Consequently, it contributed immensely to the Nigerian economy within these periods. However, Mgbeje (2005) reported that Nigeria's rubber output has declined sharply to less than half of its level of production at the beginning of the 1990s when production grew from 68,000 metric tonnes in 1975 to 116,000 metric tonnes in 1995 before it started a steady decline to 46,000 metric tonnes in 2004. For instance, between 1970 and 1986 the output of rubber decreased from 65,000 metric tonnes to 36,000 metric tonnes, representing a decrease of 56.3 percent (CBN, 2000). Also between 1992 and 1996, rubber output decreased from 129,000 metric tonnes in 1992 to 91,000 tonnes in 1996, representing about 29.5 percent decrease (Rubber Statistics Bulletin, 2000). Hence, export of rubber declined leading to its reduced contribution to the Nigerian economy. This decline in production is linked to its laborious production methods, use of low quality/low yielding planting materials, infrequent

maintenance and destructive (poor) tapping methods, inadequate marketing outlets, competition through the use of synthetic rubber, high costs of inputs, unstable prices due to lack of adequate marketing information (Agwu 2006).

Natural rubber which is traditionally native to the Amazon jungle of South America was introduced to Nigeria from England around 1895, with the first rubber estate established in Sapele in the present day Delta State in 1903 (Giroh *et al*, 2007). Rapid growth of rubber production was noticed by 1925, there were already thousands of hectares of rubber estates that were predominantly owned by Europeans in Southern Nigeria. It should be noted that Nigeria has a very vast potential for rubber production especially in many of the southern States in the country where the vegetative and climatic conditions are suitable for its production.

Aigbokaen *et al* (2000), Abolagba and Giroh (2007) reported that rubber can be grown extensively in most of the states in the southern part of Nigeria (Edo, Delta, Ogun, Ondo, Abia, Anambra, Akwa-Ibom, Cross River, Imo, Ebonyi and Rivers states) where the annual rainfall range between 1800mm and 2000mm per annum.

The most important part of the rubber tree from the grower's view point is the bark, which contains the latex – producing tissues (Delabarre and Serier, 2000). The authors added that the primary and major product of rubber-latex (the milky juice obtained from the rubber tree) is very useful as it contains about 25 to 45 percent rubber by weight and can be processed into secondary products such as crepe rubber, crumb rubber and sheet rubber for onward processing into finished products. Rubber performs basically three functions in the Nigerian economy which includes the provision of raw materials for agro-based industries, foreign exchange earnings and in the provision of employment. With regards to the provision of raw materials; rubber and rubber products can be put into almost innumerable uses. The latex from rubber is a vital material in the automobile industry as it is used in the manufacture of tyre, car bumpers, transmission belt, car mat, seats etc. The latex is also used for the manufacture of adhesive, baby feeding bottle teat, condom, domestic and industrial gloves, balloons, balls, eraser among others (Abolagba *et al,* 2003). Apart from latex, the rubber tree produces seeds and wood, which are also of economic value to the grower. The rubber seeds when processed produce oil alkyd resins used for paints, soap, skin cream and hair shampoo. The rubber seed cake left as residue after the oil has been extracted from it is also valuable in compounding livestock feeds (Agwu 2006).

Windapo (2002) viewed assessment of factors influencing farmers' adoption of new innovations as an important consideration in adoption studies.

Many researchers are of the view that the non-adoption of improved farm practices and implementation of new innovations is one of the major reasons for low productivity in agriculture, and natural rubber production is not an exemption (Aigbekaen *et al*., 2000; Giroh *et al*., 2007). It is against this background that we sought answers to the following research questions:-

i. What improved rubber technologies are available in the study areas?
ii. Are the rubber farmers aware of these technologies?
iii. To what extent have farmers adopted the technologies?
iv. What factors determine the adoption of these technologies?

Objectives of the study

The general objective of the study was the determinants of adoption of improved technologies by small scale rubber farmers in the study area. The specific objectives:

1. To examine the socio-economic characteristics of small scale rubber farmers.
2. To ascertain smallholders awareness of the use of improved rubber technologies.
3. To identify the factors affecting adoption of improved rubber technologies.

Hypothesis of the study (Ho): The socio-economics characteristics of small holder rubber farmers has no significant influence on their adoption of improved production Technology(ies)

METHODOLOGY

Area of the study

The study was carried out in Edo South senatorial zone. Edo state is made up of three (3) senatorial zones namely: Edo South, Edo Central and Edo North senatorial zones. Edo South senatorial zone wich is prefered for this study consists of seven (7) Local Government Areas namely: Oredo, Egor, Ikpoba-Okha, Ovia North-East, Ovia South-West, Orhionmwon and Uhunmwonde. However, the three (3) major Local Government Areas predominant in rubber production the state namely Ovia North-East, Ovia South-West and Uhunmwonde were purposively sampled for this study.

The climatic and vegetative of these areas were favourable the growth and establishment of rubber plantations. Oredo and Egor Local Government Areas that are not rubber producing areas in the zone were not sampled due their rapid growing developmental and urbanizational tendencies.

Edo State has a population of about 3,233,366 people which accounts for approximately about 2.4% of the total

population of the country (NPC, 2006). It has a land area of 19,819km^2 and a population density of 163.14. It lies between longitude 05^0 04' North and 06^0 43' East and latitude 05^0 44' and 07^0 34' North. It is bounded in the north by Kogi State, on the south by Delta State, on the west by Ondo State and on the east by Kogi and Anambra States. It is made up of 18 Local Government Areas.

Edo State has two major vegetational belts namely: the Forest Belts of the south and central parts while the Guinea Savannah is in the northern part. The mean annual rainfall in the northern part of the state is between 127cm-152cm while the southern part is about 252–254cm of rainfall. The average temperature ranges from a minimum of 24^{0}c to about 33^{0}c (FOS, 1994).

Scope of the study: The study focused on small scale rubber farmers in three (3) local government areas of Edo south senatorial zone namely: Ovia North-East, Ovia South-West and Uhunmwode. The sampled size was 150 small scale rubber farmers in the study areas.

Sampling Technique and Sampling Size

The sampling frame consisted of 150 rubber farmers in the study area. The list of rubber farmers was obtained from Edo state ministry of Agriculture and rural development, tree crops unit of the Federal Ministry of Agriculture. However, 137 farmers responded to the questionnairs.

A multi-stage sampling technique was employed as follows:

Stage 1: One senatorial zone was purposively selected from the three senatorial zones of Edo state.

Stage 2: The three local government areas so selected are known to have small scale rubber farmers; they includes Ovia North-East, Ovia South-West and Uhunmwonde; these were selected from Edo south senatorial zones.

Stage 3: Six (6) communities (i.e. two each from a local government area producing rubber were purposively selected) from the list of the registered communities that was provided by Edo State Ministry of Agriculture, Tree Crop Unit.

Stage 4: From the list of the registered farmers provided by the Ministry of Agriculture, Tree Crop Unit, twenty-five (25) rubber farmers were randomly selected in each community, making a total of 150 farmers used for the study.

Data collection instrument

For the purpose of this study both primary and secondary data were used. The latter was extracted from documented facts. The primary data was obtained through the use of well structured questionnaires to elicit information from rubber farmers (respondents) in the study area.

Data collection procedure

Data were collected with the assistance of Edo State Agricultural Development project (EDADP) extension workers and Rubber Research Institute of Nigeria (RRIN), Iyanomo (near Benin-City, Edo state) extension workers who were trained on the methods of administering the questionnaires and eliciting information from the respondents were engaged. The socio-economic characteristics data elicited from the respondents include: their level of awareness and adoption of improved rubber technologies and the constraints faced by the farmers in the adoption of these technologies. Oral interview was also used to obtain some vital information that were not captured by the questionnaires.

Measurement of variables

1. **Contact with Extension Agents: -** Contacts with extension was measured by the number of times respondents were visted by Extension agents whether they were visited in every month for extension work or not visited.
2. **Sources of information on improved rubber production practices: -** Respondents were asked to indicate which of these eight information sources are available to them by ticking the one that is most appropriate; ADP/Ministry of Agriculture, RRIN organized Workshop/ Seminar, Trade fairs, Newspaper, Rubber Estates, Radio/ TV, Friends and Cooperative societies.
3. **Adoption of Rubber Technology: -** This was measured by advicing the respondents to tick either of the following options; aware, not aware, adopted and never adopted on each of the eleven (11) improved technology associated with rubber production in the study area. The farmers total adoption score were obtained by summing the proportion of the eleven technologies in usethey are still using.

RESULTS AND DISCUSSION

Reports from table 1 indicates the following findings.

Results from table 1 showed respondents age groups to be 31-40 years (19.7%), 51-60 years (19.7%), and >60years (39.5%) which has the highest percentage; indicating that rubber production is dominated by aged farmers and married (98.5%) indicating married and experience farmers. This findings is in consonance with Abolagba *et al* (2003) who found that aged formed major source of labour in natural rubber production and marketing. The educational qulification of the rubber farmers were 83% (at least primary education) indicating that the farmers were literate coroborating Ogunfiditimi (1981) and Igbinosa (2008) who found the level of education of farmers in Oyo and Ondo States in Nigeria to have positive significant relationships to adoption of improved varieties of cassava, maize and cocoa. Also supporting this view. Few respondents (17.5%) had farm size below 1.5 hectares. Most of them (54%), had farm

size between 1.5 – 2.5 hectares while 28.5% had farm size greater than 2.5 hectares. This result is in conformity with Aigbekaen *et al* (2000) who reported that small farming holdings constitute more than 70% of all farming activities in Nigeria. Most of the respondent (55.3%) had farm monthly income of less than N20,000. However 44.5% of them had a monthly income of more than N20,000.

Table 1: Socioeconomic Characteristics of respondents

(n= 337)

Educational level	Frequency	Percentage
Age (Years)		
31-40	27	19.7
41-50	24	17.5
51-60	27	97
>60	56	39.5
Gender Distibution		
Male	137	100
Female	0	0
Marital Status		
Married	135	38.5
Single	2	1.5
Housedhold Size		
9-12	62	45.3
13-16	20	14.6
Educational Status		
Non-formal Education	23	16.8
Primary education	35	25.5
Post primary Education	72	52.6
Tetuary Education	7	5.1
Farm size (Ha)		
1.5 and below	24	17.5
1.6 – 2.5	74	5.4
>2.5	39	28.5
Income (Monthly)		
<10,000	21	53.5
10,000-20,000	55	40.2
>20,000	61	44.5

Field Survey 2015

Table 2 shows the distribution of respondents on the basis of extension agents' contact with rubber farmers. The result revealed that only 18.2% of the respondents had contact with extension agents which invariably shows that shows that extension delivery in the study area was contact was very poor and this will definite impede rubber production in the study area.

Table 2: **Respondents Contact with Extension Agents**.

Variables	Frequency	Percentage
Response	(whether visited or not)	
Yes	25	18.2
No	112	81.8
Total	137	100
Frequency of visit		
Never	112	81.8
Twice	25	18.2
Total	137	100

Source: field survey, 2015

The result on the sources of information clearly shows that the respondents in the study area lacked technological information from Government agencies such as ADP/Ministry of Agriculture and RRIN (Agencies charged with the responsibilities of developing appropriate technology and disseminating same to the rubber farmers). 17.5% of the respondents obtained information from rubber estates, 3.6% from cooperative societies and 0.7% from Rubber Research Institute of Nigeria (RRIN) organized workshop/seminar. Technologies adopted in the study area were weeding, (100%) fire trace (92.7) and pruning (49.6%). This is in consonance with Igbinosa (2008) who found that regular weeding of rubber plantations is good field hygiene and it creates airy and less humid environment which leads to the reduction of microbial attack on rubber latex.

Table 3: Technologies awareness and Respondents' Adoption Capacity

Technology	Awareness Frequency	Percentage	Adopted Frequency	Percentage
Weeding	137	100	137	100
Fire trace	130	94.9	127	92.7
Pruning	72	52.6	68	49.6
Holing/dibbling	15	10.9	14	10.2
Intercropping	3	2.2	1	0.7
Improved clones of rubber				
{(NIG) 800 and 900 series}	-	-	-	-
Spacing (6.7m x 3.4m)	-	-	-	-
Thinning	-	-	-	-
Cover cropping	-	-	-	-

Source: field survey, 2015.

Table 4. reveal that the estimated functions were evaluated in terms of the statistical significance of R^2 as indicated by F-value, the significance of the coefficients as given by the t-value, the signs of the coefficient and the magnitude of standard errors. Based on these statistical, economic and econometric criteria, the linear form was selected as the best

fit and result is presented in table 4. From the table, it could be deduced that age, total innovations that the respondents were aware of and farm size carry the expected signs. Also, 83.8% variation in the regress and (adoption of rubber technology) was explained by the regressors. Similarly, the F value was statistically significant at 5% probability level indicating model fitness.

Table 5: Holder rubber: Relationship between Socio-economic Characteristic of Small farmers and adoption of farm technologies Linear regression

Variable	Coefficient	Standard error	t.value
Constant			
X_1 = Farming experience	.330	.259	1.275Ns
X_2 = Household size	-.003	.005	-.667Ns
X_3 = Times visited by extension agents	-.040	.036	-1.108Ns
X_4= Educational level	-.002	.040	-.040Ns
X_5 = Age	-.077	.043	-1.792Ns
X_6 = Income	.013	.058	.224Ns
X_7= Total innovations aware of	-.011	.046	-.230Ns
X_8 = Farm size	.986	.040	24.400***
F value 90.389***			
R^2 .921			
R^2 .848			
R^2 adjusted .838			

Source: Data analysis, 2015
***, (significant at 5% probability level)
Ns, not significant

Conclusion and Recommendations

The study identified lack of awareness as the major reason why adoption of improved technologies in the study area was hindered. The most adopted technology were weeding,creation of fire trace and pruning. The use of improved clones of rubber not adopted in the study area. Contact with extension was a mirage and that impeeding adoption and approprate yield. In view of the above findings, the study recommended that Agricultural Extesion contact should be vigorously improved and collaborative effort should be made by all the extension agencies in the area. Regular training should be organizing for the rubber farmers in order to improve their capacity and their yield. Youth involvement should be vigorously pursued in order to sustsain rubber production.

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