A Probit Analysis of the Propensity to Adopt Improved Rubber Clones among Small Holder Farmers in Southern Nigeria

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Abstract: The propensity to adopt improved rubber clones among small holder rubber farmers in Edo and Delta states, Nigeria was evaluated using 300 rubber farmers randomly selected and served with a well structured interview schedule. Data collected were analyzed using probit model to determine factors that influenced the probability of farmers to adopt Hevea clones. Empirical analysis of the result revealed that 76.67 percent of the farmers adopted improved clones. The probit analysis indicated that farm size, extension contact and income significantly influenced the propensity to adopt improved clones among farmers.
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1.Introduction

Natural rubber planting material is obtained mainly by vegetative propagation where *Hevea* genotype with high latex yielding ability is desired. The budded stumps or clones have high yield potential of 2000 – 3500 kg/ha/yr for NIG 800 and 900 series while adapted (exotic) clones have latex yield of 900 to 1600 kg per hectare per year of dry rubber (Omokhafe and Nasiru, 2004). This can be obtained through budding techniques. The principle involved is the replacement of the shoot system of a rootstock with that of the desired ones (scion). The patch of the bark of the seedling plant (stock) is replaced with a patch of the bark with dominate bud (bud patch) taken from the genotype to be multiplied (scion) and this preserves the genetic constituent of the desired genotypes from one generation to the next (Delabarre and Serier, 2000; Idoko *et al.,* 2007). A demand- supply gap (3:1) of improved planting material has been reported in the rubber belt of Nigeria. The implication is that farmers resorted to using volunteer seedlings or wildings for plantation establishment instead of the improved budded stumps. This has the disadvantages of low yield and other undesirable secondary characteristics such as poor bark regeneration, poor girth regeneration, etc.

Rogers(2003) defined an agricultural innovation is a new idea, method, practice or technology perceived as new which provides the means of achieving a sustained increase in farm productivity consequently leading to improved living standards. Innovation can get to the society through the following ways: discovery, invention and diffusion. Discovery occurs when people become aware of new ways of doing things, invention is a process by which new ideas are developed or created which is different from the old method and diffusion is a process by which new ideas or method of doing things in one cultural system or society infiltrate to another system. Individual innovation is not an instantaneous act, rather, it is a process that occurs over a period and consists of series of actions, awareness, interest, trial, evaluation and adoption (Rogers, 2003).

According to Rogers (2003), awareness is the first step that leads to eventual adoption or rejection of innovation by farmers. For a farmer to arrive at a decision on adopting or rejecting an innovation, he has to undergo a number of decision making processes. For example, economic returns to his efforts especially where he considers the financial demands of acquiring and using the technology as higher than his expected gains, he is most likely to reject such an innovation.

Three methods of adoption rates have been reported in literature: i. where crops are involved- rate is the ratio of land area under the technology of interest to the total area under the crop in reference multiplied by 100 percent; ii. the use by farmers of a number of improved practices and measured by an adoption score (numbers of improved practices used or by an adoption quotient(number of improved practices used over total number of recommended practices(Herdt and Capule,1983) and iii.the multiplication of the ratio of adopting farmers to the total farmers in the sample by 100 percent and it is popular because of its simplicity in computing adoption rates(Maiangwa, 2008).

Considerable researches conducted in Nigeria on adoption behaviour of farmers indicated

that adoption were affected by a number of factors such as age, education, family size, farm size, credit and extension contact. Both positive and negative relationships between adoption and several factors have also been reported. Okoye (1988) identified inadequate extension visits, inadequate credit, poor road networks and inadequate market as factors affecting adoption. Education and old age are also factors known to affect adoption behaviour of farmers. Aigbekaen *et al.*, (2000) conducted a study on adoption of some recommended agronomic practices of natural rubber in Nigeria and found that farmers that are close to Rubber Research Institute of Nigeria (RRIN) adopted natural rubber technologies earlier than those far away from the institute. The study further revealed that the adoption rate of RRIN developed clones were lower than the exotic clones and were attributed to lack of awareness of the RRIN developed clone. Ugwa and Abubakar (2006) evaluated the adoption of improved rubber planting material among small holder farmers in Nigeria and reported 43% adoption of RRIN developed clones.

Giroh *et al. (* 2007) conducted a study on the quantitative analysis of the adoption of improved rubber innovations and identified high cost of seedlings, long distance from source of purchase, inadequate extension information, old age of the farmers, inadequate credit facility, low farm income and high production cost as factors affecting the adoption of rubber technologies in the rubber belt of Nigeria. Scarcity of labour, long gestation period of rubber cultivation, inadequate market and poor prices are factors affecting the adoption of rubber technologies (Giroh *et al.,* 2008). Ndongo *et al.* (2010) conducted a study on the socio-economic determinants of adoption of budded planting materials in Cameroon and identified access to bud wood and mastery of budding success as factors that enhance the adoption of planting material.

The study was conducted to evaluate the propensity to adopt improved clones among farmers in Edo and Delta States, Nigeria. The specific objectives were to determine rates of adoption of improved clones and to identify factors that influence the propensity to adopt the improved clones.

2. Methodology

2.1 The study area and sampling frame

The study was conducted in Edo and Delta States of Nigeria. Edo State lies between latitudes 5^o 44´´ and 7^o 34´ N of the equator and between longitudes 5^o 04´ and 6^o 43´ E of the Greenwich Meridian while Delta State lies between latitude 5^0 00´ and 6^0 30´ N of the equator and longitude 5^0 00´ and 6^0 45´E of the Greenwich Meridian (Emokaro and Erhabor, 2006, Ike, 2010). Edo and Delta States have suitable climate for the cultivation of rubber and is the major rubber growing States of Nigeria. Major rubber growing Local Government Areas: Ikpoba Okha, Ovia South West and Uhunmwode and Ika North East, Ndokwa East and West in Edo and Delta States respectively were purposively selected where structured questionnaire were administered to a total of 350 rubber farmers selected using proportionate and random sampling technique out of which 300 respondents who provided the desired information were used for analysis.

2.2 Data analysis

The data collected were analyzed using descriptive statistics and empirical probit model. Descriptive statistics such as frequency, percentages were used to explain the adoption behaviour of farmers. The empirical probit model was estimated using E- view software, version 5 to determine the probability of farmers adopting improved clones of natural rubber. Mesike and Okoh (2008) reported that probability was given as index which was un-observable.

The un- observable index was a linear combination of observable explanatory variable expressed as production function postulated for rubber farmers in the study area is implicitly presented by equation (1)

$$Y = B_0+B_iX_i = e_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where: Y = dichotomous dependent variable

B_0 = intercept, B_i = regression coefficients that explain the probability for the adoption of improved clones and X_i are the independent variables (i = 1 to 8) that were used in the study (Table 1).

3. Results and Discussion

3.1 Adoption of improved planting material and associated factors

Data in Table 2 shows the adoption of rubber clone. The adoption rate was high (76.67%) while only 23.33% are non adopters. This implies that farmers who adopted the use of improved planting material will have increase yields in their farms resulting to increased income of the farmers. This can lead to expansion in the scope of production and adopting new techniques of farming.

The estimated probit model is given in Table 3. The estimation was obtained by Quadratic Hill climbing iterative procedure. The likelihood ratio test had a chi square value of 116.29 with 8 degrees of freedom implying that the estimated model is highly significant. The model is considered to be a good fit and consistent with theory. Mc Fadden R^2 (0.548)

indicated fitness to the data. This is interpreted like the coefficient of determination in the production function. The entire estimated coefficients carried the expected signs which indicated that an increase in these variables would lead to the propensity to adopt rubber clones.

Table 1. List of variables used in the probit model and their units and expected signs

Variable	Unit	Expected sign
Y(dependent variable)	Dummy(1- adopted, otherwise zero)	
Independent variables		
Farm size (X_1)	Hectares	+
Age (X_2)	Years	+
Literacy (X_3)	Years spent in school	+
Farming experience (X_4)	Years	+
Extension contact (X_5)	Number of visits	+
Household size (X_6)	Number of persons	-
Yield (X_7)	Kilogramme of dry rubber	+
Income (X_8)	Naira	+

The coefficient for farm size was positive and statistically significant at five percent level. Farm size has been identified by Extension expert as a critical factor in the adoption of innovation in agriculture. Farmers need land to implement any improved technology and without land farmers cannot produce. This result is in line with previous studies conducted by Giroh *et al.,* (2006), Mesike and Okoh (2008) who found out that land is significantly related with adoption. The coefficient for extension contact was positive and significant and in conformity with theory. Regular extension visit with farmers was found to influence farmers' adoption of improved technologies which in the long run shifts the farmers' production efficiency upward. This result is in agreement with the findings of Onyeweaku *et al.,* (2005) who reported a considerable improvement in the efficiency of farmers when extension visit is regular. Income was significantly related with the adoption of rubber clone.

Access to extension has been widely reported to positively influence adoption and continued use of agricultural technology (Knowler and Bradshaw, 2007). Most agricultural innovations were not developed on farmers' fields and needed to be purchased. Framers require capital or financial resources to purchase them and impose the need for credit to enable them adopt these innovations. Asset endowments of farmers are one of the variable factors associated with the adoption and continued use of improved seeds. With more income, farmers are likely to expand their scope of production and adopt technologies. The result in this study is in agreement with a study conducted by Yustus *et al.,* (2010) which found out the rubber farmers in the high income group are receptive to the adoption of improved rubber technologies as their chances to production credit was higher than those of the low income group.

4. Conclusion and Recommendation

The study revealed a higher adoption rate of rubber clone by farmers. The probit model analysis indicated that farm size, extension contact and income were the influential factors of farmers' propensity to adoption of improved rubber clones.

It is hereby recommended that farmers should form cooperative society to enable them access production credit. Government should also re strengthen extension activities and review land use act to enable farmers acquire land for rubber production in the study areas.

Table 2. Distribution of respondents based on adoption of improved planting material

Variable	Frequency	Percentage
Adopted	230	76.67
Not adopted	70	23.33
Total	300	100

Source: Field survey, 2010.

Table 3. Parameters of the probit model

Variable	Coefficient	Standard error	Z.statistics
Farm size	1.634163	0.581263	2.811402**
Age	0.062673	0.040634	1.542399
Literacy	0.043298	0.065584	0.660196
Farming experience	0.060976	0.062543	0.974954
Extension contact	0.192790	0.065843	2.928038**
Household size	0.003362	0.002804	1.199074
Yield	0.674741	0.560888	1.202988
Income	0.152624	0.070498	2.164949**

Source: Data Analysis 2011. Mc Fadden R^2 = 0.548 ** Significant at 5 percent probability level.

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