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Adoption of Improved Maize Production Technologies in Enugu State, Nigeria

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Abstract – **This study examined the adoption of improved maize production technologies in Enugu State, Nigeria because of the rising price of maize occasioned by lagging supply as against growing demand for the product. It specifically described socio-economic statistics of the maize farmers, identified levels of adoption of improved maize production technologies, and ascertained the determinants of level of adoption of the technologies. Multistage and random sampling methods were used to select 250 respondents for the study. Data were analyzed by means of descriptive statistics and logistic regression analysis. Results showed male dominance (56.5%) of maize production, and highest level of adoption (80%) attained with use of hybrid maize seeds. Level of adoption was statistically and significantly determined by educational level, membership of social group, farm size and cost of technology and weakly influenced by gender, age, farming experience, household size and extension visit. Subsidization of the cost of inputs and provision of credit facilities would enable the farmers more access to improved technologies, enhanced productivity, and ensure enterprise sustainability.**

Keywords – **Adoption, Production Technologies, Maize, Enugu State, Nigeria.**

I. Introduction

Production of sufficient food for the populace is one of the major challenges facing developing countries of the world. It is estimated that over 800 million people of the world are malnourished. About 34 million of the people live in Asia while 186 million live in Sub-Saharan Africa [1]. This development is probably due to low agricultural productivity resulting from low rate of adoption of improved agricultural production technologies in most developing countries including Nigeria [2].

Maize is one of the important grains in Nigeria, not only on the basis of the number of farmers that engage in its cultivation, but in its economic importance as food and industrial raw materials for human and livestock products [3]. This explains the significant role of maize production to sustainable development of the economy. Improved maize production technologies that are capable of raising the farmers' productivity include improved maize seeds, cropping methods, fertilizer and agro-chemicals, pests and diseases control measures, and harvesting techniques [4]. The improved technologies are passed to the farmers through the extension agents in order to raise their productivity and income [5].

In Enugu State, the maize crop is farmed by most households. The farmers adopt the improved maize production technologies in their practices. Despite the place of maize as one of the leading food and industrial crops in Nigeria, it has not been produced in sufficient quantities for human and industrial needs of the country. This could be attributed to low productivity of the maize farmers as a result of low adoption of improved production technologies due to constraints to adoption such as poor extension services [4]; limited fund, scarcity and high cost of inputs, diseases and pests attacks among others [6]. Since agricultural production innovations have no value if they are not taken to the end users, identification of the factors determining adoption of improved technologies will help improve the effectiveness of research and extension services, and thereby directing agricultural policy towards increased productivity of traditional farmers [7]. This study, therefore, aimed at examining the adoption of improved maize production technologies in Enugu State, Nigeria by describing socio-economic factors of the maize farmers, ascertaining levels of adoption of the technologies, and determining influence of socio-economic factors of the farmers on level of adoption of the technologies.

II. Materials and Methods

The study which was carried out in Enugu State, Nigeria covered all the maize farmers who adopted improved maize production technologies in their production activities. The State covers an area of approximately 7161 km2 with a population of 3.3 million people by 2006 census [8]. The area lies approximately within longitude 7°30'E and 7°30'E and latitude 5°40'N and 6°45'N [9]. Maize cultivation is a common feature of all the communities in the area. The State is composed of 17 Local Government areas: Enugu South, Igbo-Eze South, Enugu North, Nkanu, Udi Agwu, Oji-River, Ezeagu, Igbo-Eze North, Isi-Uzo, Nsukka, Igbo-Ekiti, Uzo-Uwani, Enugu East, Aninri, Nkanu East and Udenu.

Multistage and random sampling methods were used to select five LGAs, five communities from the selected LGAs and ten farmers from each of the selected communities at stages I, II, and III respectively to arrive at 250 respondents. Data were collected through the administration of pre-tested interview instruments. Data were collected on socio-economic characteristic of the respondents, and improved maize production technologies in the area.

Data on level of adoption were analyzed by means of descriptive statistics – means, frequency counts and percentages while the influence of socio-economic

characteristics of the farmers on level of adoption of the improved technologies was ascertained using a logistic regression analysis of the data collected on socio-economic characteristics of the farmers and level of adoption of the technologies.

The Logistic regression model is represented explicitly by taking Y as a probability, P and making its logarithm to depend linearly on the independent variables. The probability is expressed by Pindyck and Rubinfeld [10] as:

$$\text{Prob}(Y_i = 1) \quad f(Z_i) = \frac{1}{i - e^{zi}} = \frac{e^{zi}}{e^{zi} + 1}$$

Where:

Z_i = Theoretical variable (observable variable). To obtain the value of Z_i, the likelihood of observing the sample needs to be formed by introducing a dichotomous response variable Y_i such that: Y_i = (1 if the i^{th} farmer is high adopter of maize production technologies; 0 if the i^{th} farmer is a low adopter of maize production technologies).

For this study

$$Z_i = \beta o + \beta_1 GEN + \beta_2 AGE + \beta_3 FAE + \beta_4 EDL + \beta_5 HHS + \beta_6 MSG + \beta_7 ETV + \beta_8 FAS + \beta_9 COT + e$$

Z_i = Cumulative logistic distribution
GEN = Gender (dummy: male = 1; female = 0)
AGE = Farmers' age (years)
FME = Farming experience (years)
EDL = Educational attainment (years of schooling)
HHS = Household size (number in the household)
MSG = Membership of social organization (dummy: member = 1; otherwise = 0)
ETV = Contact with extension agent (number of contacts)
FAS = Farm size (hectare)
COT = Cost of technology (₦)
β_i = regression coefficients
β_0 = Constant
e = Error term

III. Results and Discussions

Socio-economic statistics of the maize farmers

Table 1 shows the socio-economic statistics of the maize farmers. Majority (56.5%) of the farmers were males. Average age, household size, educational level, and farming experience were 42 years, 7 persons, 6.7 years, and 13.4 years respectively. Most (86%) of the farmers were married while means of farm size and extension visit were 0.8 hectare and 2 visits per year respectively. The implication of this statistics was that most maize farmers in the area were married, experienced, fairly educated and in their youthful age. Though average farm size was small and extension visit per year poor, the afore-mentioned figures of their socio-economic characteristics placed them in a position to achieve high levels of adoption of the improved maize production technologies, improve their productivity, profit and standard of living. Despite the good record of socio-economic statistics, high cost of the technologies which scored high (80%) on responses of the farmers might have constrained the achievement of high level of adoption of the technologies and consequently the farmers' productivity.

Table 1: Socio-economic statistics of the maize farmers

Variable	Mean/Mode
Gender	male (56.5%)
Age	42 years
Marital status	married (86%)
Household size	7 persons
Educational level	6.7 years
Farming experience	13.4 years
Farm size	0.5-3 hectares
Extension visit	2
Cost of technology	high (80%)

Source: Field survey data, 2013.

Table 2: Levels of adoption of the maize production technologies

Technology	Level of Adoption	
	Frequency	Percentage
Hybrid maize seeds	80	80
Fertilizers	45	45
Agro-chemicals	40	40
Organic manure	20	20

Source: Field survey, 2013. Note: Multiple responses recorded.

Levels of adoption of maize production technologies

Result of analysis of data collected on levels of adoption of improved maize production technologies (Table 2) indicated that use of hybrid maize seeds came first with 80% adoption level, followed by use of fertilizer (45%), use of agro-chemicals (40%) and finally, use of organic manure (20%). This result implied that the levels of adoption of the improved maize production technologies (apart from use of hybrid maize seeds which is the cheapest in acquisition) attained by the farmers would have been higher if not the problem of high cost of the technologies. That is, the cheaper the technology, the higher the level of adoption. The farmers indicated that high cost of the technologies seriously constrained the levels of adoption of the various production technologies attained by them (Table 1). Despite the low level of adoption of the use of organic manure achieved by the farmers, it is encouraging considering the high cost implication involved in the purchase/preparation, transportation, handling and application of the manure *vis a vis* the health and environmental friendliness of the input.

Effect of socio-economic characteristics of the respondents on level of adoption

The binomial logistic regression was used to determine the influence of socio-economic factors of the respondents on level of adoption of improved maize production technologies. The regressors were gender represented by GEN, age (AGE), farming experience (FAE), educational level (EDL), household size (HHS), membership of social group (MSG), extension visit (ETV), farm size (FAS) and cost of technology (COT). Data on the variables were fitted to the model and ran using E-Views STATISTICS. The result indicated that four regressors (educational level, membership of social group, farm size and cost of technology) had significant influences on level of adoption

of the improved maize production technologies while the rest five (gender, age, farming experience, household size and extension visit) were not significant.

Table 3: Determinants of level of adoption of maize production technologies

Parameter	Coefficient	T-ratio	Probability
Constant	-1.590	-15.334	0.103
GEN	-0.024	-1.298	0.018
AGE	0.004	0.303	0.131
FAE	-0.131	-0.012	0.071
EDL	0.043	4.039**	0.000
HHS	-0.008	-0.869	0.223
MSG	0.022	2.488**	0.001
ETV	0.007	0.688	0.116
FAS	0.046	2.027*	0.000
COT	-0.038	-3.952**	0.000
Log likelihood function	57.234		
Restricted log likelihood	44.135		
Chi-squared	35.841		

Source: Field survey, 2013. Notes: ** = Significant at 1% level. * = Significant at 5% level of probability.

Educational level had positive and statistically significant influence on level of adoption of the technologies at 5% probability level. This implied that educated maize farmers in the area were more likely to adopt the improved maize production technologies, improve their productivity and earn higher income.

The coefficient of membership of social group was positive and statistically significant ($p<0.05$). The implication is that the farmers who belonged to social groups were privileged to access improved maize production technologies and consequently produced more output. This was possible because the three tiers of government in Nigeria make use of social groups to get extension services, including packages on improved production technologies, closer to farmers so as to achieve integrated rural development and better standard of living for farmers. This finding corroborates [11] who expressed the view that, for farmers of different agricultural zones to adopt a new agricultural technology, they must be aware of the technology, have valid and up-to-date information on the technology, the applicability of the technology to their farming system and receive the technical assistance necessary for application of the technology.

The coefficient of farm size was positive and statistically significant at 1% level. This implied that the larger the maize farmers farm size the higher the income earned from maize production likewise the resources available to procure more improved technologies and achieve higher level of adoption of the technologies. Nenna and Ugwumba (2012) reported the problem of limited fund as one of the major constraints to the adoption of improved production technologies of oil palm. Cost of improved maize production technologies was implicated as a negative and significant determinant of level of adoption of the technologies. This implied that the level of adoption of the technologies was negatively affected by high cost of the technologies and positively affected otherwise.

The chi-squared value of 35.841 was significant at 1% level, an indication of the overall significant and goodness of fit of the model. The significant log likelihood function's value (57.234) also confirmed the goodness of fit of the model and that the independent variables together had statistical and significant influence on level of adoption of maize production technologies in the area.

IV. Conclusion

Maize farmers in Enugu State adopted improved maize production technologies in their production activities; however, level of adoption was negatively affected by cost of the technologies. Taking proactive measures by government to achieve success of the current Agricultural Extension Transformation Agenda, in addition to subsidization of inputs (hybrid maize seeds, fertilizers and agro-chemicals) will ensure reduced cost of production, enterprise sustainability, higher profit and better life for the farmers.

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