DIFFERENTIALS IN RETURNS AND ADOPTION OF IMPROVED CASSAVA VARIETIES BY FARMERS IN UMUNNEOCHI AREA OF ABIA STATE, NIGERIA

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ABSTRACT

The study analysed the determinants of adoption of improved cassava varieties by farmers in Umunneochi LGA of Abia State, estimated the level of adoption of the improved varieties and compared the yield and income among adopters and non-adopters of improved cassava varieties. A multistage sampling technique was used to collect information from eighty farmers comprising forty adopters and non-adopters each. Primary data was collected through the use of questionnaire. Data were analysed by the use of descriptive statistics, probit model, six point likert rating adoption scale and Z-test statistics. The results of the descriptive statistics show that the study area is female dominated, majority of the respondents are still in their productive age, married with large family size and well experienced in cassava farming. Most of the adopters planted TMS 30001 and TMS 30555 but at evaluation stage of adoption of these cassava varieties. The probit analysis show that the coefficient of marital status, educational status and farming experience were positively signed and significant at 10% and 5% respectively. The coefficient of income was also positively signed and highly significant at 1% level. The adopters performed better than the non-adopters in terms of yield and income from the cassava varieties planted. The results therefore call for policies aimed at encouraging the farmers to increase their production and income through adoption of improved cassava varieties. There is also need for provision of free and affordable education to enable the farmer's access and process information on improved varieties available to them.

Keywords: Adoption and Improved Cassava Varieties

INTRODUCTION

Cassava (Manihot esculenta Crantz) is an important staple food and cash crop in several tropical African countries especially Nigeria where it plays a principal role in the food economy (Agwu and Anyaeche, 2007). Cassava is a staple food crop in south-eastern Nigeria and it contributes about 15% of the daily dietary energy intake of most Nigerians and supplies about 70% of the total calories intake of about 60 million people in Nigeria (Ezulike et al., 2006). Nigeria is the world's larges producer of cassava, with about 31.4 million metric tones and ranks 2nd after yam in extent of production among the root and tuber crops of economic value in Nigeria (FAO, 2006).

The crop is one of the most dominant and main crop components in crop mixtures in south-eastern Nigeria (Ikeorgu and Iloka, 1994) and it is gradually gaining importance as an industrial crop (Muoneke and Mbah, 2007). Data from the Collaborative Study of Cassava in Africa (COSCA) showed that 80% of Nigerians in the rural areas eat a cassava meal at least once weekly (Nweke et al. 2002).

Rogers (1995) demonstrates that adoption of technologies depends on their characteristics: compatibility with the existing values and norms, complexity, observability, trialability, and relative advantage. This definition pertains to technologies in a variety of disciplines, and may be as relevant in other fields as it is in agricultural related technologies. In dairy production in 5 states in the US for instance, El-Osta and Morehart (1999) identify age of operator, size of operation and specialization as important factors in increasing likelihood of technology adoption, while research by Caswell, et al., (2001) ascertains that high levels of farm operator education are likely to induce adoption of management technologies. Others say lack of adequate inputs and active information4 (Feder and Slade, 1984) may be obstacles to adoption. These studies pertain to technologies in the developing countries but could apply to less developed countries.

Several parameters have been identified as influencing the adoption behaviour of farmers from qualitative and quantitative model. It is against this background that research of this nature was initiated in the study area to ascertain factors influencing adoption and to what extent the farmers have adopted the use of improved cassava varieties considering a comparative advantage the area has as a neighbouring community to national root research institute to benefit from most research outcomes from this institution.

METHODOLOGY

The study was conducted in Ummuneochi Local Government Area of Abia State. It is located between longitudes 6.2^0 and. 6.4^0 East and latitude 7.3^0 and 7.5^0 North. A tropical region dominated by two seasonal conditions. The hot dry season starts in November and last till April. It alternates with the rainy season which last from May to October. The major food crops grown in area include cassava, maize, cashew, melon plantain and rearing of livestock. A multistage sampling technique was used to select eighty respondents comprising forty adopters and non-adopters of improved cassava varieties each. Primary source of data used were collected through the use of well-structured questionnaire and personal interview. Data were analyzed using descriptive statistics such as tables, frequencies and percentages for the socio-economic characteristics of the respondents, while adoption rate was analyzed by the use of a 6 point likert rating scale. The Probit regression analytical model was used to estimate the determinants of the rate of adoption of improved cassava varieties among the farmers in the study area.

Model Specification

The adoption scale of six point likert rating scale developed by Caswell et al, (2000) was adopted in this study to measure the level of adoption of improved cassava varieties among farmer adopters. The six point likert rating are: adoption (6), trial (5), evaluation (4), interest (3), aware (2) unaware (1). Respondents with mean score of 3.50 and above imply they are at the adoption, trial or evaluation stage while respondents with mean score of less than 3.50 are either unaware, aware or at interest stage.
To determine the mean likert level, each item was computed by multiplying the frequency of each respondent pattern with its appropriate nominal value and dividing the sum with the number of respondent of this items. This can be summarized with equation below:

$Xs = \sum fn/N$ ------------------------- 1

Where Xs = mean score

$\sum$ = summation
F = frequency
n = likert nominal value
N = number of the respondent
Xs = 1+2+3+4+5+6/6 = 21/6 = 3.50.

Determinants of adoption of improved cassava varieties were analyzed using the Probit model. Conceptually, probit analysis is a probability model often used in adoption studies because of its usefulness in providing estimates which are asymptotically consistent and efficient. Decision to adopt or not is a discrete choice which is often affected by a vector of explanatory variables (Xi-Xn). Following Guerre and Moon (2004) probit model in Udensi et al (2011), the model is specified implicitly as:

Yi = Xiβ + Ui if Xiβ + Ui >0 …………………… 2
Yi = 0 if Xiβ + Ui < 0 ---------------------3

Where
Y = dichotomous response variables (dummy variables;0 = non-adopters, 1 = adopters)
i = 1,2---------,N number of observation Xi = vector of independent variables; β = vector of unknown coefficient; Ui = independently distributed error term assumed to be normal with zero mean and constant variance while the independent variables included as
X_1 = age (years)
X_2 = Farm size (ha)
X_3 = Education (years)
X_4 = households size
X_5 = access to credit (dummy variable; 1=yes, 0=no)
X_6 = member of cooperate society (dummy variable; 1=member, 0=non-member)
X_7 = marital status (dummy variable; 1=married, 0=otherwise)
X_8 = farming experience (years)
X_9 = farm income (₦)
X_{10} = number of extension contacts.

Z – test statistics was used to test for differentials in cassava yield between adopters and non-adopters. The model is specified thus;

$$\frac{\bar{X}_1 + \bar{X}_2}{\sqrt{\frac{\delta_1^2}{n_1} + \frac{\delta_{2+}^2}{n_2}}}$$

Where $\bar{X}_1$ = mean cassava income and yield for adopters
$\bar{X}_2$ = mean cassava income and yield for non-adopters
δ_1^2 = standard error of income and yield for adopters
δ_2^2 = standard error of income and yield for non adopters
n_1 = number of adopters
n_2 = number of non-adopters

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Respondents

The results in table 1 show the frequency distribution of respondents according to their socio-economic characteristics. The results show that majority (55% adopters and 65% non-adopts) of the cassava farmers were females while 45% and 55% of the adopters and non-adopters were males respectively. Gender issues in agricultural production and technology adoption have been investigated for a long time. Most show mixed evidence regarding the different roles men and women play in technology adoption. Doss and Morris (2001) in their study in factors influencing improved maize technology adoption in Ghana, and Overfield and Flemming (2001) studying coffee production in Papua New Guinea show insignificant effects of gender in adoption.

The results also show that only 2.50% and 12.50% of the adopters and non-adopters were less than 41yrs old while 22.50% and 25.00% were within the age range of 41-50yrs respectively. Many (40.00% o the adopters and 32.50% of the non-adopters) are within the age range of 51-60yrs. About 35.00% and 30.00% of the adopters and non-adopters were greater than 60yrs respectively. This shows that the study area is dominated by the aged farmers. Age is said to be a primary latent characteristic in adoption decisions. However there is a contention in the direction of the effect of age on adoption (Bonabona-Wabbi, 2002). Nwaru (2004) found out that the ability of a farmer to bear risk, be innovative decreases with age.

Majority (55.00% and 45.00%) of the adopters and non-adopters had household size of between 8-10 persons respectively while 12.50% of the adopters and 7.50% of the non-adopters had greater than 10 persons. However, only about 2.50% and 7.50% of the adopters of non-adopters had household size of less than 5 persons. This shows that the study area is dominated by farmers with large household sizes. Because larger households are more likely to provide labour that might be required in cassava production, a larger household size would be expected to increase the probability of adopting improved technologies. Effiong (2005) and Idiong (2005) reported that a relatively large household size enhanced the availability of labour.

The results on educational level of the respondent’s shows that about 2.50% of the adopters and 22.50% non-adopters had no form of formal education while majority (77.50% adopters of 52.50% non-adopters attained primary level of education. About 15.00% and 20.00% of the adopters and non-adopters attained secondary level of education while 5.00% each attained tertiary level of education. Educated farmers are expected to be more receptive to improved farming techniques, while farmers with low level of education or without education would be less receptive to improved farming techniques (Okoye et al, 2004)

The results show that 10% of the adopters and 25.00 of the non-adopters had less than 16 yrs of farming experience while 22.50% and 12.50% had between 16-20yrs respectively. About 10.00% and 17.50% of the adopters and non-adopters had between 21-25 yrs of farming experience respectively as well as 15.00% and 22.50% whom had between 26-30 yrs also. The results also show that 42.50% and 22.50% of due adopters and non-adopter had more than 30yrs of farming experience respectively. This shows that the study area is dominated by farmers who are experienced. With more experience, a famer can become less averse to the risk implicated by adopting a new technology (Mafuru et al., 1999).

Table1: Distribution of Respondents According to Socio-Economic Characteristics

	Adopters		Non adopters	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Gender				
Male	18	45.00	14	35.00
Female	22	55.00	26	65.00
AGE				
<41	1	2.50	5	12.50
41-50	9	22.50	10	25.00
51-60	16	40.00	13	32.50
>60	14	35.00	12	30.00
Household size				
<5	2	50	3	7.50
5-7	11	27.50	16	40.00
8-10	22	55.00	18	45.00
>10	5	.50	3	7.50
Educational Status				
None	1	2.50	9	22.50
Primary	31	77.50	21	52.50
Secondary	6	15.00	8	20.00
Tertiary	2	5.00	2	5.00
Farming Experience				
<16	4	10.00	10	25.00
16-20	9	22.50	5	12.50
21-25	4	10.00	7	17.50
26-30	6	15.00	9	22.50
>30	17	42.50	9	22.50
Cooperative Membership				
Yes	13	32.50-	-	-
No	27	67.50	40	100.00
Total	**40**	**100.00**	**40**	**100.00**

Source: Field Survey, 2014

The results show that 13.50% of the adopters belong to cooperative societies while none of the non-adopters were members. Majority (67.50%) of the adopters do not belong to any form of social organisation. Acquisition of information about a new technology demystifies it and makes it more available to farmers. Information reduces the uncertainty about a technology's performance hence may change the individual's assessment from purely subjective to objective over time (Caswell et al, 2001).

Improved Varieties Planted by Farmers in the Study Area

The results in table 2 show the frequency distribution of the adopters according to improved varieties planted in the study area. The results show that the most important improved varieties planted by the farmers was TMS 300001 (55.00%) and ranked the highest (1st), this was followed by TMS 30555

(47.50%), others (30.00%), TMS 30395 (27.50%), NR 8212 (22.50%) and TMS 91934 (12.50%) which ranked 2nd, 3rd, 4th, 5th, 6th and 7th respectively.

Table 2: Frequency distribution of respondents according to improved varieties planted

Improved variety	Frequency	%	Rank
NR 8010	3	8.00	8
NR 7706	1	2.50	10
NR 8083	1	2.50	10
NR 8212	9	22.50	5
NR 83107	3	8.00	8
TMS 30001	22	55.00	1
TMS 30572	6	15.00	6
TMS 30555	19	47.50	2
TMS 91934	5	12.50	7
TMS 50395	11	27.50	4
Others	12	30.00	3

* = multiple responses

Others were; NR 8010 and NR 82107 (8.00%), NR 7706 and NR 8083 (2.50% each) and ranked 8th and 10th respectively. Okoro, (1995) reported that considerable amount of research has been done to generate new technologies and practices that will increase output of cassava at the farm level. Earlier studies by Dorp and Rulkens (1993), Springer et al (2002), Kimenju et al, (2005) and Nwawuisi et al (2007) show that farmers decision to use a particular crop cultivar were influenced by a number for reasons, some of which are market driven or socio-culturally based.

Level of Adoption of Improved Cassava Varieties by Farmers in the Study Area

The results in table 3 show the lickert rating analysis of the level of adoption of improved cassava varieties in the study area. The results show that the variety, TMS 30001 (4.50) was at the trial stage and ranked 1st, followed by TMS 30555 (4.38) at the interest stage and ranked 2nd and TMS 50395 (3.65) at the evaluation stage and ranked 3rd. The results also show TMS 91934 (3.05) at interest stage, NR 8082 (3.03) and NR 8083 (3.00) at interest stages also and ranked 4th, 5th, 6th and 7th respectively. Others were; NR 83107 (2.90) and NR 7706(2.90) at interest stage each, NR 8210 (2.33) and NR 8012 (2.02) at awareness stage and ranked 8th, 9th, 10th and 11th respectively.

Table 3: Rating scale analysis of level of adoption of improved cassava varieties by farmers in the study area

Variety	1 Unaware	2 Aware	3 Interest	4 Evaluation	5 Trial	6 Adoption	Total	Mean	Rank
NR 8012	19 (19)	12 (24)	3 (9)	-	6 (30)	-	82	2.05	11
NR 8082	14 (14)	16 (32)	10 (30)	5 (20)	5 (25)	-	121	3.03	6
NR 8210	17 (17)	6 (12)	10 (30)	1 (4)	6 (30)	-	93	2.33	10
NR 7706	12 (12)	7 (14)	7 (21)	10 (40)	3 (15)	1 (6)	108	2.70	9
NR 83107	9 (9)	8 (16)	11 (33)	5(20)	4 (20)	3 (18)	116	2.90	8
NR 8083	10 (10)	6 (12)	8 (24)	9 (36)	4 (20)	3(18)	120	3.00	7
TMS 30001	3 (3)	6 (12)	4 (12)	3(12)	3 (15)	21 (126)	180	4.50	1
TMS 30572	9 (9)	4 (8)	4 (12)	7 (28)	8 (40)	8 (48)	145	3.63	4
TMS 30555	5 (5)	4 (8)	1 (3)	7 (28)	7 (35)	16 (96)	175	4.83	2
TMS 91934	11 (11)	6(12)	7 (21)	7 (28)	4 (20)	5 (30)	122	3.05	5
TMS 50395	5 (5)	7 (14)	5(15)	7 (28)	6 (30)	9 (54)	146	3.65	3

Determinants of Adoption of Improved Cassava Varieties

The results in Table 4 show the probit regression estimates of the determinants of adoption of improved cassava varieties in the study area.

Table 4: Probit regression estimates of the determinant of adoption of improved cassava varieties among the farmers in the study area

Variable	Coefficient	Std error	t-value
Constant	-10.4882	4.3012	-2.44**
Sex (X_1)	-1.0741	0.8151	-1.32
Age (X_2)	0.0758	0.0561	1.35
Marital status (X_3)	1.4511	0.7618	1.90*
Occupational status (X_4)	-2.1728	0.8027	-2.43**
Household size (X_5)	-0.1406	0.1905	-0.74
Education (X_6)	3.1811	1.2551	2.53**
Farming experience (X_7)	0.1408	0.0588	2.39**
Income (X_8)	0.00003	0.0000009	3.41***
Chi square (X)	86.26***		
Pseudo R^2	07878		

Source: STATA 4A Survey Data, 2014

*, ** and *** is significant at 10%, 5% and 10% level of probability respectively.

The results show that the chi square value of 86.26 was highly significant at 1% level of probability indicating that the model is a good fit. The R^2 value of 0.7878 also indicates 78.78% variability in adoption of improved cassava varieties explained by the independent variables. The coefficient for marital status was positively signed and significant at 10% level of probability. This implies that farmers who are married adopted improved cassava vary more than their counterparts who are either single or widowed. This is expected because spouses are able to take joint decisions to better improve their output and productivity.

The coefficient for education was positively signed and significant at 5% level of probability. This implies that only increase in education will lead to increase in the probability of adoption of improved cassava varieties. Generally education is thought to create a favourable mental attitude for the acceptance of new practices especially of information – intensive and management intensive practices (Caswell et al, 2001).

The coefficient for farming experience was positively signed and significant at 5% level of probability. This implies that any increase in years of farming experience will lead to increase in probability of adoption of improved cassava varieties. With more experience, a farmer can generate confidence (Mafuru et al, 1999).

The coefficient for income was positively signed and highly significant at 1% level of probability. This implies that any increase in income will lead to increase in the probability of adoption of improved cassava varieties by farmers. The decision to adopt is often an investment decision (Bonabana-Wabbi, 2002). And as Caswell et al (2001) noted, this decision presents a shift in farmer's investment options.

The coefficient for occupational status was negatively signed and significant at 5% level of probability. This implies that the part-time farmers adopted improved varieties more than their full-time counterparts. This is not expected probably because, most of the part-time farmers were educated and had more access and can process information better than their full time counterpart.

The coefficients for sex and household size were negative but not significant as well as age which was positively signed.

Comparative analyses between Yield and Income of Adopters and Non Adopters of Improved Cassava Varieties

The results in table 5 show the Z-test analysis of comparison of yield and income between adopters and non-adopters if improved cassava varieties in the study area. The result shows a Z statistic of 8.368 and 9.387 for yield and income respectively. These were highly significant at 1% level of probability indicating a significant difference in yield and income of the adopters and non-adopters of improved cassava varieties. The adopters performed better than their counterparts whom are non-adopters with a mean income and yield of ₦354,375 and 10.587t/ha higher than ₦147,475 and 3.98t/ha.

Table 5: Z test analysis of yield and income between adopters and non adopters of improved cassava varieties

Variable	Number	Mean	Standard Deviation	Standard Error	Z-statistic	Pr>t
(A) Yield						
Adopters	40	10,587.5	4,805.7	759.85	8.368***	<0.0001
Non adopters	40	3,980.0	1,358.6	214.81		
(B) Income						
Adopters	40	354,375	128,922	20,384	9.387***	<0.0001
Non adopters	40	147,475	53,018	8,382.9		

Source: STATA 4A results
*** is significant at 1% level of probability.

CONCLUSION

The results show differentials in returns and adoption of improved cassava varieties by farmers in Umunneochi area of Abia state, Nigeria. The results show that adopters of improved cassava varieties had more income than their counterparts whom are non-adopters. Important factors directly related to adoption are marital status, occupational status, education, farming experience and income. The results therefore call for targeting relevant policies at experienced cassava farmers as measures for increased adoption of improved varieties in the study area. This will lead to increased production and income among the cassava farmers. There is also need for the intensification of training and educational programs for potential adopters.

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