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EXTENT OF UTILIZATION OF COCOYAM VALUE ADDED TECHNOLOGIES AMONG RURAL HOUSEHOLDS IN SOUTH-EAST NIGERIA

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ABSTRACT
The study examined the extent of utilization of cocoyam among rural households in South East Nigeria. A multi-stage random sampling procedure was employed in selecting 480 respondents for the study. Data were collected from primary sources with the use of structured questionnaires, and analyzed using descriptive and inferential statistics. The results show that majority (75.84%) of the cocoyam farmers were females, who were married (82.27%) and attained secondary (39.27%) and tertiary (27.57%) levels of education. Many (53.03%) of the respondents were full-time farmers, who had no access to credit (75.8%) and do not belong to any social organization (61%). Many (55.6%) of the respondents had contact with extension, and earned not more than N50,000 (79%) monthly. Results show that cocoyam is utilized mainly as soup thickener (3.53, =3.44 and =3.91 for Abia, Ebonyi and Enugu States respectively). Important factors influencing utilization of cocoyam value added technologies include: age, farm size, access to credit, monthly income, and membership of social organization. The results therefore, call for land re-form and credit policies aimed allocating more land and provision of credit at little or no interest rate to cocoyam farmers who are still strong and agile. There is also need to encourage farmers to form groups/cooperatives for ease of access to technology innovations to enhance utilization of value-added cocoyam technologies.

Keywords: Utilization, Cocoyam, and Nutritional Sustainability

Introduction

Cocoyam is a tuber crop with lots of potentials and a large number of households grow cocoyam as cash crop, selling at least half of their yearly production. As food, cocoyam corms and cormels are eaten in homes in various forms. They can be boiled or roasted like yam, pounded alone or mixed with cassava and eaten with soup. The corms and cormels, when sliced, can be dried and used to make flour or fried to make chips. The leaves of the plant and flower are also edible and are usually consumed as vegetable and spice to garnish food in dishes such as stews (Chukwu *et al*., 2012). Nigeria is the largest producer of cocoyam in the world, accounting for about 31.04% of total world output (FAO, 2018). The crop is highly medicinal for diabetic patients because it has low starch content, easily digestible and contains protein more than tuber crops (Eleazu *et al*., 2013). The leaves of *C. esculenta* have been shown to be rich source of folic acid, riboflavin, vitamins A and C, calcium, phosphorus (Mahajan *et al*., 2015). Cocoyam is a useful cover crop and the corms are ready for harvesting in 6-9 months. This particular crop sustained *Biafrans* during the civil war in Nigeria between 1966-1970 (FAO, 1990). Cocoyam crop is accepted as a crop that can guarantee food security because it is relatively low-priced and could therefore feed many rural poor households (Baruwa and Oke, 2012).

In Nigeria, cocoyam is grated, mixed with condiments and wrapped in leaves and steamed for about 30minutes to prepare a delicacy popularly known as *ekpankwukwo (ikokore*). Cocoyam flakes is another end product of cocoyam which is cooked, cut into chips and dried under the sun. The resulting flakes are later soaked in water and cooked with vegetable and pigeon pea (*Cajanus cajan*) during famine or planting season when food is scarce (Onwuka, 2012). Other uses of cocoyam include maintaining healthy urinary function, reducing ageing and heart diseases, management of cholesterol and diabetes (Kumawat *et al*., 2010).

Nutritionally, cocoyam is superior to cassava and yam, and taro starch is also more readily digested.

Prior to the civil war in Nigeria, cocoyam utilization was very high particularly in the southern part of the country. The end of the war came with the flooding of market with exotic foods and huge reduction in the use of cocoyam. Hence, the National Root Crops Research Institute (NRCRI), Umudike initiated a *Cocoyam Rebirth Programme*, the outcome of which was the compilation of *Cocoyam-Based Recipes* which is a collection of confectioneries and non-confectionery cocoyam-based foods (Nwosu, 2009). Cocoyam (*Colocasia esculenta and Xanthosoma mafafa*) is an important carbohydrate staple food in the southern and middle belt areas of Nigeria (Asumugha and Mbanaso, 2002). South-east agro-ecological zone is generally fertile and all the States in the zone cultivate and utilize cocoyam.

Malnutrition in Nigeria and other developing nations is traced to the consumption of low quality and quantity of food (Nnabuko *et al*., 2012). Similarly, Zuhair and Hunter (2000), stated that this all-important crop with all its wonderful attributes and potential has been neglected. The production of cocoyam especially in South-East Nigeria is labour-intensive with most operations carried out manually at the traditional level (Okoye *et al.,* 2008). Despite the wide adaptability, and nutritional and economic values of the crop, cocoyam has received minimal interest and attention by producers, consumers and even researchers. The potentials of cocoyam for food security, income generation and nutritional enhancement in the households seem to be grossly underutilized. Achieving agricultural transformation in Nigeria would be a mirage if developed technologies remain in the research stations. One way of achieving the transformation is to have an effective system of technology transfer. In order to have expected impact on national development in the area of cocoyam production and utilization, improved technologies on cocoyam production and value-addition must be made available to those in the production systems. Transfer of technology is usually the responsibility of the agricultural extension service. Against this background, it was pertinent to assess the extent to which the farmers in South-East agro-ecological zone, Nigeria, have utilized cocoyam production and value-addition technologies developed transferred by the NRCRI, Umudike.

Methodology

The study was carried out in the South-East agro-ecological zone of Nigeria. The choice of this region was informed by the fact that agriculture is the largest employer of labour in the zone. Purposive and multi-stage random sampling techniques were employed in selecting 480 respondents for the study. In the first stage, three out of five States in the zone were purposively selected basically because of high intensity of cocoyam production and utilization in the States. The states include: Abia, Ebonyi, and Enugu. At the second stage, two Agricultural Zones were randomly selected from each State. At the third stage, two blocks were randomly selected from each zone. At the fourth stage, four circles in each of the selected blocks were randomly selected. Finally, ten (10) cocoyam farmers were randomly selected from each circle, giving 160 from each State. Thus a sample size of four hundred and eighty (480) respondents was randomly selected from the population. The services of agricultural Extension Agents were engaged in locating and collecting data from the respondents. Data were collected mainly from the primary sources with the use of questionnaire and structured interview schedule.

Model Specification

A 5 point likert rating scale was used to measure the extent of use of cocoyam value added technologies (Y) in the study area using very high (5), high (4), moderate (3) low (2) and very low (1). Respondents with mean score of 3.00 and above imply high extent in the use of cocoyam value added technologies, while respondents with mean score of less than 3.0 were low. To determine the mean likert level = Xs = ΣX. Xs of each item was computed by multiplying the frequency of each response pattern with its appropriate nominal value and dividing the sum with the number of respondent to the items. This can be summarized with the equation thus:

$$\overline{X} = \frac{\sum n}{N} \quad (1)$$

Where, Xs =mean score
Σ = summation
f= frequency
n = likert nominal value
N= number of respondents

$$= \frac{5+4+3+2+1}{5} = \frac{15}{5} = 3.0$$

The Ordinary Least Square Regression Model was used to estimate the determinants of level of utilization of cocoyam value added technologies in the study area. The model is specified implicitly thus:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_9, X_{10}, X_{11}, X_{12}) + e \quad (2)$$

Where,
Y_1 = cocoyam value addition technologies used (mean score rank from 1-5)
X_1 = Sex (male = 1; female = 0)
X_2 = Age (years)
X_3 = Marital Status (married = 1, others 0)
X_4 = Level of Education (years)
X_5 = Occupational status (full-time farmer = 1; part-time = 0)
X_6 = Farming experience (years)
X_7 = Farm size (ha)

X_8 = Household size (actual number of persons living in a household)
X_9 = Monthly income (naira)
X_{10} = Membership of Social Organisation (yes = 1; otherwise = 0)
X_{11} = Access to credit (access = 1 ; otherwise = 0)
X_{12} = Extension contact (Number extension contacts in a year)

Results and Discussion

Socio-economic characteristics of the respondents

The results in Table 1 show the distribution of respondents according to socio-economic characteristics. The results for the sex distribution of the respondents presented on Table 1 shows that majority (75.84%) of the respondents were females. This indicates more female involvement in cocoyam production in the area. There is this perception in some localities in the study area that, apart from yam, every other root and tuber crop is a woman's crop. The result is in tandem with the findings of Ekwe *et al.,* (2016), who noted that there are more female farmers in Nigeria, and contrasts the findings of Otitoju and Arene (2010), that Nigerian agriculture is dominated by males. Result also shows that 37.13% of the respondents were aged between 41 – 50 years. This is followed by those with age range of 51 – 60 years (29.13%). However, only about 22.74% were between 0 and 40 years or less. The trend was similar in the three States, where larger population of the farmers were between the age range of 41 – 60 years. Youth has been classified as people within the age bracket of 15 – 35 (NBS, 2016). The result, therefore, showed that the youths are yet to tap into the numerous opportunities in cocoyam production expressed by Nnabuko *et al.*, (2012) and Chukwu (2015). Majority (82.27%) of the respondents were married, while 13.3% and 4.43% were widowed and single respectively. The result implies that cocoyam farmers in the study area are largely married and are actively engaged in their businesses in order to adequately carter for their family members (Ohen *et al.*, 2014; Onumadu *et al.*, 2014 and Ekwe *et al.*, 2016)**.**

Many (39.27%) and (27.57%) of the respondents attained secondary and tertiary levels of education respectively. The result was also true for the States with higher attainment in secondary and tertiary education. The result generally showed that the level of literacy of the respondents were relatively high, but a bit lower in Ebonyi State where about 21.3% had no formal education, compared to Abia (6.7%) and Enugu (5.6%) States. Ebonyi State is regarded as an educationally disadvantaged State, although, significant improvement has been recorded in recent times. Ajah (2012), stated that education enhances farmers ability to make accurate and meaningful management decisions. Apu and Nwachukwu (2008) also indicated that farmer's educational level positively influenced their adoption of improved technologies. Engagement in full time or part time agricultural production activities is most likely to affect attitude to agro-technology adoption. The result (Table 1) shows that many (53.03%) of the respondents were full-time farmers, while 46.97% were part-time farmers. However, the result varied from across the States. For instance, while larger proportion were part time farmers in Abia (60.0%) and Ebonyi (63.3%), Enugu recorded majority (82.4%) as full-time farmers. The result could be because, in the study area, some people combine trading, civil service and artisanship with agricultural production. Majority (75.8%) of the respondents had no access to credit. The situation across the three States did not in any way differ. Access to credit needs to be addressed to encourage food production, especially among the rural farmers, who would remain subsistent in their food production, except, there is an intervention that will empower them to produce more. Low access to credit among rural farmers has been reported by many authors (Adebayo and Adeola, 2008; Ololade and Olagunju, 2013). Abu *et al., (*2011) and Ugbajah (2014) noted that access to agricultural credit was positively linked to agricultural productivity in Nigeria. Low access to credit could be because of poor information on credit facilities, unfavourable government policy on agriculture, lack of collateral including limited access to land, bureaucratic bottlenecks, and credit policies, among others (Ekwe *et al.,* 2016)

Results also show that majority (61%) of the respondents did not belong to any social organization, although the result varied across the three States. For instance, in Ebonyi State, a larger proportion (80.6%) belonged to social organization, while the result differed in Abia and Enugu States where a larger proportion of the respondents (67.9% for Abia and 95.0% for Enugu) did not belong to any social organization. Membership of social organization provides a platform for information sharing on modern production techniques, purchasing inputs in bulk, and labour exchange. This has been observed by Ekwe *et al.,* (2016), Wole-Alo and Olaniyi (2015), as being a major factor influencing the output of farmers. Membership of cooperative society, as observed by Simonyan *et al.,* (2012), can assist farmers in raising their production output and minimizing cost since the group would be able to take advantage of the economies of scale, overcome barriers to assets and better management of available resources. Many (55.6%) of the respondents had contact with extension, while others (44.4%) did not. The result further shows that although the level of extension contact in the zone was relatively high, the result varied across the three States studied. For instance, In Abia State, 63.7% have had contact with extension and 81.2% in Ebonyi State, but a large proportion (78.1%) of the respondents from Enugu State had no

contact with extension. The result of the monthly income of the respondents as presented in Table 1 revealed that many (79%) of the respondents earned N50,000 and less per month, with same trend in the three States. Akinbile, (2014), Ekwe and Nwachukwu, (2011), Apu and Nwachukwu, (2008), reported that low income earners have inadequate fund to acquire certain technologies. The result implies that a relatively high poverty rate exists among the farmers which is characteristic of the farming system practiced in the rural area where returns from investment is low as a result of low level investment by subsistence farmers (Ekwe *et al.*,2016; Babatunde and Qaim, 2009). The extent of utilization of cocoyam value added technologies among the respondents in the study area is presented in Table 2.

Extent of Utilization of Cocoyam Value Added Technologies

The result in Table 2 showed that cocoyam soup thickener (3.62), was the only important value added technology above the mean benchmark of 3.0. The result further showed a slight variation across the three States of Abia, Ebonyi and Enugu. Interestingly, apart from cocoyam soup thickener, which recorded a mean score of 3.53, 3.44 and 3.91 for Abia, Ebonyi and Enugu States respectively, Ebonyi followed with Use of cocoyam leaves for soup (3.01) as another value addition technology. Ijioma *et al.,* (2014) in their study in Abia State also observed high utilization of Cocoyam soup thickener among others. The result also showed low extent of use of most of the value added technologies in the study area. The result is an indication of the poor awareness of the respondents on these technologies which if not addressed, would continuously deter the utilization of these technologies. The essence of value addition is to increase economic gains from agricultural production. It is, therefore, not enough to produce more without commensurate efforts to increase market share of what is being produced through value addition. This result agrees with Onyenweaku and Ezeh (1987) and Nnabuko *et al*., (2012), considering the nutritional quality of cocoyam, high starch content and its quality (*i.e*. fine starch grains), the level of utilization of cocoyam and its products both for domestic and industry is quite low.

Determinants of Utilization of Cocoyam Value Added Technologies

The result in Table 4 showed the regression estimates of the determinants of cocoyam value added technologies in the study area. Four functional forms of multiple regression were estimated and the Double-log functional form was selected based on the magnitude of the R^2 value, number of significant variables and F value. The R^2 (coefficient of multiple determination) value of 0.86 implies 86.0% of the observed variations in the dependent variable were accounted for by the independent variables. The F–value was significant at1%, indicating that the model was good. The coefficient of age was significant at 10% level and negatively related to level of utilization of cocoyam value added technologies in the study area. This implies that a 1% increase in age will lead to a 0.370% decrease in utilization of cocoyam value added technologies. Nwaru (2004) found out that the ability of a farmer to break risk, be innovative decreases with age.

The coefficient of farm size was statistically significant at 1% and directly related to utilization of cocoyam value added technologies in the study area. This implies that a 1% increase in farm size will lead to a 0.107% increase in utilization of cocoyam value added technologies among the farmers in the study area. Farm size affects adoption costs, risk perceptions, human capital, credit constraints labor requirements, tenure arrangements and more. With small farms, it has been argued that large fixed costs become a constraint to technology adoption (Abara and Singh, 1993) especially if the technology is costly. The coefficient of household size was significant at 5% level and directly related to level of utilization of cocoyam value added technologies in the study area. This implies that a 1% increase in household size will lead to a 0.006% increase in level of utilization of cocoyam value added technologies. The increase of household size suggests that more family labour would be readily available since relatively large household size is an obvious advantage in terms of labour supply, where wage rate is relatively costly (Nwaobiala, 2013).

The coefficient of income was significant at 5% and directly related to level of utilization of cocoyam value added technologies. This implies that a 1% increase in income will lead to a 0.143% increase in level of utilization of cocoyam value added technologies. This may be because; increase in income will enable the farmers to adopt new production strategies. Programs that produce significant gains can motivate people to participate more fully in them (Bonabana-Wabbi, 2002). The coefficient of membership to social organizations was significant at 1% and directly related to utilization of cocoyam value added technologies. This result implies that a 1% increase in the membership to social organizations by farmers will lead to a 0. 290 increase utilization of cocoyam value added technologies. Acquisition of information from social groups 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 individual's assessment from purely subjective to objective over time (Caswell *et al*., 2001). The coefficient of access to credit was significant at 1% and directly related to utilization of cocoyam value added technologies. This result implies that a unit increase in access to credit among

farmers will lead to a 0.048% increase in utilization of cocoyam value added technologies.

Conclusion

The study analyzed the extent of utilization of Cocoyam Value Added Technologies among rural households in South-East Nigeria. Results show low level of utilization of these technologies in the study area. Important factors influencing utilization of the technologies include; age, farm size, household size, monthly income, membership of cooperatives/social organization and access to credit. The results therefore, call for land re-form and credit policies aimed allocating more land and provision of credit at little or no interest rate to cocoyam farmers who are still strong and agile. There is also need to encourage farmers to form groups/cooperatives for ease of access to technology innovations to enhance utilization of value added cocoyam technologies.

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Table 1: Socio-economic Characteristics of the Respondents

Variable	Abia	Ebonyi	Enugu	Pooled
		Percentage		
Sex				
Male	32.5	30.6	9.4	24.16
Female	67.5	69.4	90.6	75.84
Age (Years)				
<30	5.3	4.4	1.9	3.87
31-40	15.8	31.9	8.9	18.87
41-50	41.4	36.2	33.8	37.13
51-60	32.9	13.1	41.4	29.13
Above 60	4.6	14.4	14.0	11
Mean	47.56	46.22	51.48	48.81
Marital Status				
Single	8.8	1.3	3.2	4.43
Married	79	85.0	82.8	82.27
Widow	12.2	13.7	14.0	13.3
Level of Education				
No formal education	6.7	21.3	5.6	11.2
Primary	20.1	25.0	20.8	21.96
Secondary	45.0	23.1	49.7	39.27
Tertiary	28.2	30.6	23.9	27.57
Occupation				
Full time farmers	40.0	36.7	82.4	53.03
Part time farmers	60.0	63.3	17.6	46.97
Access to Credit				
Yes	41.2	24.4	6.9	24.2
No	58.8	75.6	93.1	75.8
Membership of social organizations				
Yes	32.1	80.6	5.0	39
No	67.9	19.4	95.0	61
Extension Contact				
Yes	63.7	81.2	21.9	55.6
No	36.3	18.8	78.1	44.4
Monthly Income (N)				
0-50,000	62.2	88.7	86.1	79
51,000-100,000	32.9	11.3	13.9	19.4
101,000-150,000	4.2	0.0	0.0	1.4
≥150,000	0.7	0.0	0.0	0.2
Mean (N)	**47083**	**32257**	**31756**	**36694**

Source: Field Survey, 2017

Table 2: Distribution of respondents according to extent of utilization of cocoyam value added technologies in the study area

Variable	Abia	Ebonyi	Enugu	Pooled	Remarks
Utilization Technologies	**Mean**	**Mean**	**Mean**	**Mean**	
Processing corms into flour	2.57	1.23	1.94	**1.91**	**Low**
Converting cocoyam flour into bread	1.89	1.05	1.11	**1.35**	**Low**
Converting cocoyam flour to chinchin	1.99	1.19	1.04	**1.40**	**Low**
Making of cocoyam flakes	2.43	1.20	1.66	**1.76**	**Low**
Making of cocoyam cakes	1.87	1.13	1.13	**1.37**	**Low**
Use of cocoyam leaves for soup	1.75	3.01	2.68	**2.48**	**Low**
Preparing of cocoyam soup thickener	3.53	3.44	3.91	**3.62**	**High**
Grand mean	2.29	1.75	1.94	**1.98**	**Low**

Source: Field Survey, 2017

Key: Mean scores of 3.00 and above were regarded as high, while below 3.00 is low

Table 4: Regression estimates of determinants of utilization of cocoyam value added technologies in South-East, Nigeria

Variables	Linear	Exponential	Semi-log	Double log +
Constant	3324.578	8.150	6151.804	1.324
	(4.238)**	(6.913)***	(10.334)***	(10.545)***
Sex	-447.06	-0.511	-891.993	0.743
	(-1.310)	(-0.44)	(0.900)	(0.551)
Age	-4.123	-0.009	-648.511	-0.370
	(-4.090)***	(-2.907)***	(-2. 348)**	(-1.972)*
Marital Status	18.923	0.004	309.629	0.071
	(0.950)	(1.132)	(1.050)	(0.830)
Level of Education	-82.300	-0.077	-35.354	-0.117
	(-0.596)	(-0.907)	(-0.101)	(-0.685)
Occupation	9.592	0.002	420.526	0.003
	(0.690)	(1.570)	(1.062)	(0.033)
Farming experience	-33.500	-0.014	320.904	0.045
	(-0.743)	(-0.390)	(0.613)	(0.255)
Farm size	0.001	2.301E-7	52.349	0.107
	(0.860)	(6.988)***	(7.330)***	(3.716)***
Household Size	170.124	0.008	69.215	0.006
	(0.587)	(0.044)	(0.131)	(2.505)**
Monthly Income	5.313E-5	3.083E-8	267.550	0.143
	(5.596)	(0.564)	(2.079)	(2.282)**
Membership of social organizations	.781	1.614E-5	22143.785	0.290
	(14.544)***	(8.871)***	(11.343)***	(11.343)***
Access to Credit	0.054	1.766E-6	8394.982	0.048
	(0.247)	(0.633)	(0.767)	(3.390)***
Extension Contact	0.002	1.476E-6	-908.842	-0.280
	(2.875)**	(1.706)*	(-2.260)**	(-1.430)
R^2	0.67	0.78	0.85	0.86
R Adjusted	0.65	0.76	0.83	0.84
F – Ratio	34.909***	22.813***	11.942***	30.419***

Field Survey, 2017

* Significance at 10%, ** Significance at 5%, *** Significance at 1% ***

+ = Lead Equation

Values in parenthesis are t-values