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Technology Adoption and Utilization among Cassava Farmers in Ogun State, Nigeria

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Abstract

The main objective of this research work was to find out the adoption and utilization of technology among cassava farmers in the study area. A multistage random sampling procedure was adopted to collect primary data from 80 sampled cassava farmers who were randomly selected from some selected communities in the study area. Descriptive statistics, logit regression analysis and budgetary analysis were used to analyze the data collected. The result revealed that majority of the respondents have low formal education, as about 68% of the farmers only attended primary school, 67% of respondents fall within the age bracket of 31 to 50 years. It is revealed that 91% of the farmers are married with an average income of ₦34,153.21. The coefficient of farmer's age and education is positive meaning that as farmers age increase by one unit, the probability of adopting improved technologies will also increase. The budgetary analysis revealed that the average total revenue is ₦34,153.52, the average farmer's net income is ₦22,094.99 and gross margin is ₦25,818.77 with the profitability index as 0.6469. It has been recommended that the government should provide incentives for the farmers as well as increasing the rate of visit of extension agents in the study area so as to boost their level of adoption of technologies on cassava farming.

Keywords: Farming, Technology, Profitability, Adoption, Incentives

JEL classification: Q10, Q16, Q5, 031

Introduction

Agricultural technology contributes significantly to nation-building and economic growth through its roles in agricultural production and farming household welfare services. However, the traditional contribution to agricultural production has been rendered inefficient by the simple traditional and inappropriate form of agricultural technologies frequently used (Olawoye, 1988; Awoyemi, 2000). The result is a relatively low agricultural productivity which is inversely proportional to the enormous labour intensive input. It is therefore important that the use of appropriate technology by cassava farmers will improve their contributions to national development and that they will adopt improved technology if such technology is suited to their need, appropriate for their peculiarities and culture and available within their means, save time, conserve energy and are compatible with the local environment of the users. Such technology must be adaptable to the ecological climatic and physical conditions in order to be functionally relevant.

Technology has made pertinent contributions to national progress and its usefulness has attained universal recognition both at national and international levels. In many developing countries including Nigeria, lack of appropriate technological and scientific knowledge application limits agricultural and economic progress (Odebode, 1997; Akoroda and Teri, 2004). In order to keep pace with the rapid rate of food demand, that is attendant upon rapid population growth and help to improve the gloomy food situation and its consequences, continuous research in food production

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and efficient extension services is highly desirable. Technology is very crucial to development. Many developed countries rely on land and labour within the existing national environment with increasing population, which invariably increased demand for more agricultural products. Technology is indispensable in the fight against hunger, food shortage, food insecurity and low productivity (Afolami, 1997). It enhances agricultural production, fosters education and training, promotes information dissemination and facilitates effective utilization of natural resources.

In Nigeria, modern agricultural technology has contributed significantly to agricultural development and the gap between developed and developing countries in the area of agricultural production can be attributed largely to differences in the level of technological development, adaptation and transfer process. In developed nations, there is an advanced level of technical know-how and widespread application of technological innovations resulting in high productive capability in agriculture as well as in industry (Adebayo, 2006; Adeniyi, 1993; Aerni 2001). Hence, in the development of agricultural technology, it is pertinent to consider its relevance and adaptability to farmer's environment, cropping systems, needs and aspirations of the intended beneficiaries. Abang and Agom (2004) supported this view by adding that such technology should be simple, consistent with farmers' needs have no conflict with the existing local environment and have high potential for economic returns. Therefore, agricultural technologies refer to the application of new methods or techniques to all or part of agricultural activities such as cultivation, harvesting, storage, processing methods and marketing (Adekanye, 1983).

Cassava (*Manihot spp*) is widely grown in Nigeria and it is one of the most popular food crops cultivated by small scale farmers (Nweke, 1996; IITA, 1990). In recent years, there is growing realization that given the amount of by-products that can be obtained from industrial processing of cassava tubers, more hectarage would need to be devoted to cultivation of the crop. The popularity of cassava grew further in Nigeria in the last four years with the inauguration of the Presidential Task Force on Cassava Revolution, which promotes cassava cultivation on a commercial scale and process harvested products into various by products like cassava flour, cassava chips, ethanol and industrial starch for export. Nweke and Bokanga (1994) stated that one of the most important means of accelerating national development in nations with large agricultural sector is the development and adaptation of new agricultural technologies like improved crop cultivars that can be adopted by small scale farmers.

Progress in agricultural development in Nigeria depends to some extent on the willingness and ability of farm families to adopt new farm technologies that are being popularized. Different cassava varieties and several techniques of its production and processing have been developed and disseminated but farmers responses have depended on their perception of benefits derivable from given varieties, socio-cultural suitability and profitability of the production and processing techniques. Despite the release of different cassava varieties in Nigeria, cassava output per hectare of local farmers is still low (African agricultural, 2007). This can partly be attributed to farmers continued use of local cassava cultivars or landraces based on known characteristics such as colour, texture, taste and adaptability to mixed cropping systems which form bottlenecks to adoption of improved cultivars. This study is to examine the technology adoption and utilization among cassava farmers in Ogun State, Nigeria The specific objectives are to examine the existing production technologies available to the cassava producers; determine the influence of socio-economic characteristics of cassava farmers on the adoption of modern technology; and examine the cost and return structure of cassava production in the study area.

Data Sources and Methodology

Study Area and Methods of Data Collection

This research was conducted in Ijebu North-East Local Government Area of Ogun State. Both primary and secondary data were used for this study. Primary data were obtained from cassava farmers with the aid of well-structured questionnaires with due cognizance taken of the objectives of this research while the secondary data were obtained using journals, bulletins, statistical reports as well as information from textbooks (FAO, 2003; 2004).

Sampling Techniques and Sample Size

A multistage random sampling procedure was employed in the selection of sample size for this study. This involves two stages. In the first stage, four communities were randomly selected from the

Local Government Area. In the second stage, twenty respondents were randomly selected from each of the four communities in the area. Therefore, a total of 80 respondents were sampled.

Methods of Data Analysis

Both descriptive and inferential statistics were used for this study. Descriptive statistics such as frequency distribution and percentage was used to describe the socio-economic characteristics of cassava producers, income level and identification of existing production techniques; while inferential statistics such as Budgetary Analysis was used to examine the cost and return structure of cassava producers and Logit Model was used to determine the influence of socio-economic characteristics on cassava production respectively.

Model Specifications

Logit Regression Analysis was used to influence of socio-economic characteristics of the users on the adoption improved technology. In the Logit regression model, the predicted values for the independent variable will not be less than 0 and not greater than 1 regardless of the values of the independent variables. The general formula for Logit regression model is:

$$\text{Logit}(p) = \text{Log}\ \frac{p}{1-p} = \text{Log}(p) - \text{Log}(1-p)$$

$$(p/1-p) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \ldots\ldots\ldots\ldots + b_nX_n + U_i$$

Where: p = Adoption of modern technology

1-p = Non-adoption of modern technology

The independent variables are as follows.

X_1 - Age of the respondents (years)

X_2 - Sex of the farmers (Male = 1, Females = 0)

X_3 - Farm size (hectare)

X_4 - Household size (no. of persons)

X_5 - Years of formal education (years)

X_6 - Hired labour (mandays)

X_7 - Number of time of visit of extension agents

X_8 - Cropping pattern (Mono-cropping =1, others = 0)

X_9 - Number of years in cassava production

X_{10} - Annual income (Naira)

U - Error term/Stochastic residual term.

Budgetary Analysis

This model was used to examine the cost return structure of cassava production in the study area. It also gives the monetary worth in the marketing of cassava products. Some profitability ratios were calculated as follows:

$$\text{Profitability index} = \frac{\text{Net Farm Income}}{\text{Gross Revenue}} \times 100$$

Net Farm Income = TR – TC

TC = TVC + TFC; TVC = Total Variable Cost

TFC = Total Fixed Cost; TR = PQ

P = Price of the input

Q = Quantity of cassava produced.

Rate of Return on Investment = NI/TC x 100

Rate of Return on Variable Cost = (TR – TC/TVC) x 100

Operating Ratio = TVC/TR

Results and Discussion

From Table 1, the age distribution of the cassava farmers revealed that 77.4% of the cassava producers are between the age of 31 and 50 years. This means that cassava production is dominated mostly by vibrant age group, which enhance farmers' income and welfare. The sex distribution of the cassava farmers showed that about 78% are males and about 23% are females. The predominance of males is in cassava farming conforms to a prior expectation, since cassava farming is known to be a strenuous activity that is more appropriate for the male folks. Majority (about 91%) of the respondents are married means that they have family responsibilities which necessitate their curiosity to seek for more income through cassava production.

The household size distribution of the cassava farmers showed that 48% of the respondents have household size between 5 and 8 persons, which are involved in farming activities. Most of the cassava farmers (about 68%) have primary school education which implies that they have low education which could hinder the adoption of technology and understanding of extension officers. The distribution of cassava farmers by number of years of farming experience shows that 90% have about 20 years of farming experience. This implies that highest number of farmers is well-experienced in cassava farming which will improve their production performance and enhance adoption of improved technology through extension agents. About 63.8% of cassava producers were attracted into cassava production by self interest, while others were motivated

Table 1. Socio-Economic Characteristics of Cassava Producers

Variables	Frequency	Percentage	Cumulative Percentage
Age (years)			
30 or less	11	13.6	13.8
31-40	27	33.8	47.5
41-50	24	30.0	77.5
51-60	13	16.3	93.8
61 and above	5	6.3	100.0
Sex			
Male	62	77.5	77.5
Female	18	22.5	100.0
Marital Status			
Single	7	8.8	8.8
Married	73	91.2	100.0
Household Size			
4 or less	27	33.7	33.7
5-8	38	47.5	81.3
More than 8	15	18.8	100.0
Educational Level			
No Formal Education	14	17.5	17.5
Primary	40	50.0	67.5
Secondary	18	22.5	90.0
Tertiary	8	10.0	100.0
Occupation			
None	1	1.3	1.3
Farming	4	5.0	6.3
Artisan	26	32.5	38.8
Civil servant	3	3.8	42.6
Tailoring	7	8.8	51.4
Trading	31	38.6	90.0
Others	8	10.0	100.0
Farming Experience			
10 or less	36	45.0	45.0
11-20	36	45.0	90.0
21-30	6	7.3	97.5
31-40	1	1.3	98.8
More than 40	1	1.4	100.0
Extension Visit			
None	73	91.3	91.3
4 or less	2	2.5	93.8
5 or more	5	6.2	100.0
Cassava Production Experience			
10 or less	64	80.0	80.0
11-20	14	17.5	97.5
21-30	2	2.5	100.0
Farming Motivating Factors			
Self interest	51	63.8	63.8
Parental influence	14	17.5	81.3
Friends/relatives	9	11.2	92.5
Self-interest/parental influence	3	3.8	96.3
Self-interest and others	3	3.7	100.0
Total	80	100	

Source: Field Survey, 2018

into production by friends and relatives. This is evident in the farmers' commitment to cassava production, so as to earn more income thereby improving their standard of living.

Adoption of Modern Technologies

Data in Table 2 highlights the modern technologies adopted by cassava farmers and the level of use of each. The adoption of herbicide, fertilizers, pesticide, modern processing and storage techniques in cassava farming in the study area is relatively low. 75%, 49%, 55%, 73% and 93% of cassava producers do not adopt the above improved technologies in the stated order. The result generally revealed that guided planting depth, modern planting methods, and guided planting time are the most adopted modern technologies. The findings further showed that modern storage method, herbicide and modern processing techniques are the least adopted modern technologies in cassava production

Influence of Socio-Economic Characteristics on the Adoption of Modern Technology

The Logit regression model was used to estimate the influence of socio-economic characteristics on farmers' adoption of modern technology in cassava farming as shown in Table 3. The result showed a chi-squared statistic of 43.67 which is significant at 1%; this implies that the model has a good fit. The coefficient of the age of the farmer, educational level, farm size, hired labour man-days and cropping patterns have positive coefficient and statistically significant at 10% and 5% respectively. These are important variables that influence the probability of adopting improved technologies in cassava production. A unit increase in the coefficient of these variables will increase the farmers' tendencies of adopting modern technologies. However, the coefficient of household size, year of cassava production and capital investment were negative and not significant implying that increase in the unit of variables does not necessary influence the farmers' adoption level of modern technologies.

Cost and Return Analysis of Cassava Production

Data in Table 4 showed the cost and return analysis of cassava production in the study area. The result revealed that labour is the highest contributor to the Total Variable Cost (TVC) and Total Cost (TC). Labour cost had a mean value of ₦6,821.50 which forms 81.84% and 56.57% of the TVC and TC respectively. The labour cost is extra-ordinary large and this could be attributed to the fact that the use of fertilizer and agro-chemicals (herbicides and pesticides) is relatively low, which also forms part of the TVC. In most cases, farmers do not spend much money on cassava cuttings, since they would use stems of cassava plants from their previous harvest. The TFC had a mean value of ₦3,723.78 which forms about 30.88%. The Total Revenue of cassava based farming within the study area had a mean value of ₦34,153.21. The Gross Margin and Net Farm Income constitute 75.60% and 64.69% of

Table 2. Use of Modern Technologies in Cassava Production

Modern Technologies	Not used	Small extent	Large extent
Improved cassava varieties	17(21.3%)	18(22.5%)	45(56.3%)
Guided planting time	3(3.8%)	32(40.0%)	45(56.3%)
Guided planting depth	2(2.5%)	31(38.8%)	47(58.3%)
Modern planting method	2(2.5%)	30(37.5%)	48(60.0%)
Guided planting distance	5(6.3%)	29(36.3%)	46(57.5%)
Guided planting population	12(15.0%)	24(30.0%)	44(55.0%)
Use of herbicide	60(75.0%)	4(5.0%)	16(20.0%)
Fertilizer application	39(48.8%)	13(16.3%)	28(35.0%)
Use of pesticides	44(55.0%)	11(13.8%)	25(31.3%)
Processing techniques	58(72.5%)	4(5.0%)	18(22.5%)
Storage methods	74(92.5%)	2(2.5%)	4(5.0%)

Note: Values in parentheses are percentages
Source: Computed from field survey, 2018

Table 3. Estimation of influence of socio-economic characteristics of farmers on adoption of new technologies in cassava production

Socio-Economic Characteristics	Regression Coefficient	T-Value
Constant	-5.0927***	-2.704
Age	0.0751	1.690
Sex	0.180	0.231
Farm size	1.2771**	1.991
Household size	-0.0794	-0.410
Years of formal education	0.0226	0.246
Hired labour	0.0229***	3.102
Extension Agent's Visit	0.1499	0.544
Cropping pattern	1.8568**	2.438
Years of cassava production	-0.1031	-0.999
Annual income	-1.136	-0.802
Log likelihood function	-32.9882	
Chi-squared	43.6739***	
Degrees of freedom	10	

*Note: * indicates significance at 10%, ** indicates significance at 5% and *** significant at 1% level*
Source: Computed from Field Survey, 201\8

Table 4: Cost and Returns Analysis of Cassava Farming per cropping season/person

Items	Mean Amount (₦)	%TVC	%TC
Variable Cost			
Cost of cassava cuttings	601.25	7.21	4.99
Fertilizer cost	624.75	7.50	5.18
Cost of agro-chemicals	287.50	3.45	2.37
Labourer cost	6,821.25	81.84	56.57
Total Variable Cost (TVC)	8,334.75	100.00	69.12
Fixed Cost	**Amount (₦)**	**%TFC**	**%FC**
Depreciation of asset	3,723.78	100	30.8
Total Fixed Cost (TFC)	3,723.78	100	30.8
Total Cost (TC)	12,058.53	100.00	
Returns	**Amount (₦)**	**%TR**	
Total Revenue	34,153.52	100	
Gross Margin	25,818.77	5.60	
Net Farm Income	22,094.99	64.69	
Profitability Index	0.6469		
Rate of Return on Investment	183.23%		
Rate of Return on Variable Cost	365.09%		
Operating Ratio	0.244		

Source: Computed from Field Survey, 2018, ₦ stands for naira

the Total Revenue respectively. The profitability index indicates that every one naira expended on cassava production, returns 64kobo to the cassava farmer. The rate of return on investment was 183% which means that ₦1.83kobo is earned on every one naira spent on cassava production. The rate of return on variable cost was valued at 220% which indicates that every ₦1 incurred on variable input will generate ₦2.20kobo at the end of production cycle. However, the operating ratio was 0.244 which is less than one indicates that the resources used are efficient and highly profitable.

Conclusion and Policy Implications

The study concluded that adoption of modern technology by cassava farmers is relatively economical and technically efficient. Majority of the cassava farmers are in their active and productive ages. Cassava farmers are mostly male, married, educated with moderate household size which enhanced their production output through the use of adoption of modern technology and consequently improve their standard of living. In the study area, modern agricultural technology has contributed significantly to agricultural development and area of agricultural production among farmers can be attributed largely to differences in the level of technological development, adaption and transfer process.

Based on the findings and problems identified, it is therefore recommended that there is need for an advanced level of technical know-how and widespread application of technological innovations and utilization which will result in high productive capability in agriculture as well as in industry. Based on the findings, it is therefore recommended that the young farmers should be encouraged to put more efforts to their farming business order to increase their productivity and profitability level. Also, farmers should be encouraged to form a cooperative society and government should establish agricultural cooperative banks nearer to cassava farmers so as to have access to production credit.

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