ANALYSIS OF ADOPTION OF IMPROVED CASSAVA PROCESSING TECHNOLOGY IN OSUN STATE NIGERIA.

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ABSTRACT
The study investigated the level of adoption of improved cassava processing technologies in Osun State Nigeria. The study described the socio-economic characteristics of the cassava processors, evaluates the level of adoption of improved cassava processing technologies assess the effect of improved cassava processing technology on the cassava processor revenue and identify the constraints faced by the adoption of improved cassava processing technology in the study area. A three-stage sampling technique was employed to randomly sample a cross section of 159 cassava processors. Data were collected using a well-structured questionnaire. Primary data was employed using descriptive statistics, average treatment effect and Likert type scale for the analysis. The result showed that the mean age of the respondents was 42.5 years. It was also noted that majority of the technologies were still at the evaluation stage of adoption in the study areas. Furthermore, the result indicated that cassava processing technology had a positive effect on the revenue of the adopters. Inadequate credit facilities, insufficient infrastructure, high cost of machines among others are the major constraints faced by the respondents in the study area. The study concluded that out of ten (10) improved cassava processing technologies considered, the respondents have adopted only two technologies, which means the processors need to orientate how to use the technologies and make those technologies available to them. The study thus recommended that effort must be made to motivate processors through extension agents to embrace improved cassava processing technologies which will improve their production and increase their income.

Key Words: Average treatment effect; evaluation stage; processors; revenue

INTRODUCTION

Nigeria is now faced with a lot of pressure to increase her food production outputs to meet the ever-increasing population and domestic requirements. Nigeria no doubt has the potential to meet these requirements in terms of land, human and capital resources needed to produce enough food for the country (Abdoulaye, Abbas, Maziya-Dixon., Tarawali,, Okechukwu, Rusike, Alene, Manyong and Ayedun 2014). To be self-reliant in food production, therefore, the factors militating against effective and efficient production of staple crops has to be tackled. One staple crop that is capable of correcting the shortage in food production in Nigeria is cassava. Cassava is a very important economic crop cultivated in many tropical countries such as Thailand, Brazil, India and several West African countries including Nigeria. Nigeria presently ranks as the highest producer of cassava in the world with an annual output of 54million tonnes of tuberous roots (FAO, 2014). The plant itself is classified as a perennial semi shrub. Its high-

energy, carbohydrate-rich roots can be processed into a wide variety of products from food to industrial starches, which makes cassava very important economically. Currently, cassava crop is undergoing a transition from a mere subsistence crop found on the field of peasant farmers to a commercial crop that will be grown on large quantities in plantations. This expansion of cassava production is attributed to the discovery of cassava as a cheap source of edible carbohydrate that could be processed into different forms of human delicacies and animal feeds. The crop has become a basic raw material for many small-scale businesses such as cassava flour mills, bakeries, fast food firms, restaurants, gaari processing firms and is currently an income generating activity (Agboola, Yusuf, Oyekale and Salman 2015). Government intervention and the efforts of non-governmental organizations have led to a number of measures that support the production, processing and marketing of cassava. Through this effort, appreciable progress has been made in the development of processing technologies and rural infrastructure. Several labour intensive operations in processing notably, grating, dewatering and milling have been mechanized (FAO, 2014). According to IITA (2017) engineering research in Nigeria and other African countries resulted in successful mechanization of some of the laborious and time-consuming cassava processing operations. Thus, the use of appropriate technologies or machineries is essential to meet for home consumption and industrial uses. The adoption of improved agricultural technology is influenced by many factors ranging from socio-economic, institutional to technological factors (Wossen, Tessema, Abdoulaye, Rabbi, Olanrewaju, Alene, Feleke, Kulakow, Asumugha , Adebayor, and Mayong 2017). Cassava is extremely perishable, therefore, tubers harvested must be processed to curb post-harvest losses. This situation is further worsened by food losses that occur as a result of inadequate processing facilities (Adekanye, Ogunjimi and Ajala 2013).). Poor processing is a major cause of post-harvest losses in the world with special emphasis on developing countries such as Nigeria (FAO, 2014). The cassava processing operations have been reported by many authors as labour intensive. The women and children are the major producers**.** The labor-intensive processes of peeling, grating, milling, dewatering, toasting, and sifting have been linked to the low quality of locally produced cassava products. However, the level of farmers' and processors' awareness and adoption is very low and the impact has been minimal at the farm level (Ironkwe *et al* 2016). The specific objectives are to; describe the socio-economic characteristics of the cassava processors, determine the level of adoption of improved cassava processing technologies, evaluates the effect of improved cassava processing technology on the cassava processor revenue and identify the constraints faced by the adoption of improved cassava processing technology in the study area.

MATERIALS AND METHOD

STUDY AREA

The research study was carried out in Osun State of Nigeria. Osun State of Nigeria with a land area of about 9,251 square kilometers and lies between latitude 7˚30'0″ and 7˚50'0"North, longitude 4˚ 30 ' 0" and 4˚ 50 ' 0" East at an altitude of 353 meters above the sea level. It has a population of about 3,673,435 inhabitants consisting of about 1 ,840,619 males and 1,682,916 females (NBS, 2020). Osun state is located in the tropical rain forest zone of Nigeria which in most cases experiences rainfall from March ending to November of the same year while the dry season starts from January to February, thus, making the people in the area predominantly farmers. The state has a total land mass of approximately 14,875 square kilometer and lies between latitude 7˚30'0″ and 7˚50'0" North, longitude 4˚30 ' 0" and 4˚50 ' 0" East at an altitude of 353 meters above the sea level. Osun state may be classified as largely a rural state with 19 out of the 30 local

government areas being non-urban local government councils, accounting for 60% of the 1991 population. Major crops grown in Osun state include yams, cassava (manioc), corn (maize), beans, millet, plantains, cacao, palm oil and kernels, and fruits.

Sampling Techniques

The study focused on cassava processor households. The population of the study comprises all cassava processors in Orolu, Olorunda, and Egbedore local government areas in Osun state, Nigeria. A three-stage sampling technique was employed to select one hundred and sixty (160) cassava processors. In the first stage, three local government areas were purposively selected in Osun state due to predominant cassava processing in those areas. In the second stage, three communities were selected purposively because they are well known for cassava processing, the third stage is random selection of ten cassava processors (garri processors) who adopted certain technologies in each of the communities while snow-balling techniques was used to select sixty-nine non-adopters of those technologies. In total, one hundred and fifty-nine were gathered due to missing data.

Survey Areas

Selected Local government	Villages/Communities
Orolu	Abegunde, Bolorunduro and Odofin
Olorunda	Agowande, Owode and Akogun
Egbedore	Aba-Ajao, Onadimu and Olobu-Ara
Total	9

Method of Data Collection

The principal instrument for data collection was administration of a structured questionnaire. Others include structured interview and observation methods.

Sampling Design Outlay

Local Government	Number of Respondents
Egbedore	38
Olorunda	42
Orolu	79
Total	159

Methods of Data Analysis

The data collected for this research work was analyzed using the following statistical tools;

i. Likert type scale
ii. Descriptive statistical tools
iii. Average treatment effect (ATE)

MODELSPECIFICATION

LIKERT TYPE SCALE

A 5-point likert type scale was assigned weights of 5, 4,3,2,1 respectively. This was used to measure the constraints faced by the adoption of the improved cassava processing technologies. To calculate the average weighted scores of technological characteristics, the midpoint values of the scale was summed up and divided by 5 to obtain a mean score of 3. Any technological attribute with mean score of 3 and above will be considered affordable, compatible or complex. On the other hand, any mean score less than 3 will be considered not affordable, not compatible or not complete

Descriptive Statistics

Simple descriptive statistics and inferential techniques such as percentages, frequencies averages, and ranges were used in the description of the socio-economic characteristics of the respondents and to estimate the major constraints to adoption of improved cassava processing technology in the study area.

Average Treatment Effect

The average treatment effect was used to determine the effect of improved cassava processing technologies on the processors, the model for ATE is given as;

$$\frac{1}{n} E_{i=1}^{N} (Y1i - Y0i)$$

Where N = sample surveyed

Yx=1 and Yx=0 are the potential outcomes that would be observed if all individuals' exposure was set to 1 and 0, respectively.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the respondents

Table 1 revealed that the mean age was 42.5, this portrays that most of the cassava processors were still in their active and productive age when they can put in their best resources. Agboola *et al*. (2015) concluded that the more the age of farming household heads the lesser the capacity to cope with the labour-intensive nature of farming activities.

Most (74.21%) of the respondents were married. This implies that most of the respondents were saddled with family responsibility. This result was in agreement with the findings of Kehinde and Aboaba (2016) who found out that majority of the farmers in Ekiti State (98%) were married. The mean household size of the respondents was 6.9 persons. This indicated that there was a fairly large family in the study area. The implication was that the members of the family could be employed on farm activities to lower the cost of hired labour and as well improve farm productivity, the result tallied with the findings of Abdul-Azeez *et al.* (2014).

The mean year of cassava processing experience is 10.6 years. This indicates that majority of the respondents had engaged in cassava processing business for more than 10 years; that is, they are more experienced in cassava processing business in the study area.

Over 77% of the respondents were member of cooperative society in the study area. The result indicated that considerable number of the cassava processors in the study area were member of cooperative society. This might help in easy access to productive loan and marketing of their products. About 52.20% of the respondents receive extension services while

47.80% of the respondents claimed that they receive no extension service in their processing businesses. The result indicated that the extension service for cassava processor was in average, this might deter efficiency and quality control of some of the output of these processors in the study area.

Table 1: Socio-economic characteristics of Cassava Processors in the study area

Input Variable	Frequency	Percentage
Age (year)		
<=15	2	1.26
16-20	3	1.89
21-25	12	7.55
26-30	14	8.81
31-35	11	6.92
36-40	48	30.17
Above 40	69	43.40
Mean	42.5	
Marital Status		
Married	118	74.21
Single	20	12.58
Separated	11	6.92
Widowed	8	5.03
Divorce	2	1.26
Land ownership		
Inheritance	79	49.69
Community	60	37.74
Lease	13	8.18
Purchase	7	4.40
Household size		
<=5	46	28.93
6-10	99	62.26
Above 10	14	8.81
Mean = 6.9		
Cooperative Society		
Yes	123	77.36
No	36	22.64
Processing Experience		
<=5	44	27.67
6-10	73	45.91
11-15	15	9.43
Above 20	27	16.98
Mean = 10.6		

Extension services		
Yes	83	52.20
No	76	47.80
Source of capital		
Friends & Family	101	63.52
Personal	28	17.61
Bank	19	11.95
Cooperative only	11	6.92

Source: Field Survey, 2021

Level of Adoption of Improved Cassava Processing Technologies

Table 2 shows the results of the adoption level of improved cassava processing technologies. The adoption of improved cassava processing technologies was subjected to 5-point Likert scales as: awareness (1), interest (2), evaluation (3), trial (4) and adoption (5) to determine the mean threshold of adoption among cassava processors. The scale was used to ascertain the adoption stages of agricultural technologies (AT) among cassava processors. The study had a cluster mean of 3. The result showed that improved cassava processing technologies has not been fully adopted by all the processors. The result indicated that majority of the technologies were still at the evaluation stage of adoption in the study areas. This approach was adopted from Obianefo *et al* 2020 who classified their work in 5 stages of adoption (awareness, interested, evaluation, trial and adopted). Based on the 10 variables of improved cassava processing technologies considered. Frying machine and Mechanical peeler are in the awareness stage. Rasper machine was in the interest stage. Screw press machine and ccassava grater machine are in adoption stage. Also, cutting machine, filter press machine, Columbus grinder machine and dewatering were in the evaluation stage. Furthermore, extraction machine was in a trial stage of adoption. Summarily, the grand mean (cluster mean) of 3 was an indication that the farmers are still evaluating the available technologies in their areas. The results further showed that out of ten (10) improved cassava processing technologies considered, the respondents had adopted two technologies. The non-adoption of any of the variables considered has a big concern to extension delivery system. Scholars like Louise (2015) succinctly stated that extension service bears a great potential for improving the productivity of natural resources, promoting the right attitude among natural resource managers. Furthermore, extension service was recognized as an essential mechanism for information delivery and advice as input into modern resource management (Ironkwe *et al* 2016). This measure was adopted because a one-time used of technology package does not guarantee its adoption.

Table 2: **Adoption of Improved Cassava Processing Technologies**

S/N	Variables	Awareness	Interest	Evaluation	Trial	Adoption	Mean Score	Remarks/Decision
1	Cutting machine,	29	19	45	61	5	3	Evaluation stage
2	Cassava grater machine	42	39	41	28	9	3	Adoption stage
3	Rasper machine	22	110	26	0	1	2	Interest stage
4	Screw press machine	114	12	17	6	10	4	Adoption stage
5	Filter press machine	5	12	68	70	4	3	Evaluation stage
6	Frying machine	30	118	2	9	0	3	Awareness stage
7	Curumbus grinder machine	80	11	21	35	12	3	Evaluation stage
8	Mechanical peeler	30	1	6	83	0	3	Awareness stage
9	Dewatering	22	34	43	48	12	3	Evaluation stage
10	Extracti	19	12	37	82	9	3	Trial stage

Table 2: Adoption of Improved Cassava Processing Technologies

Effect of Improved Cassava Processing Technology on the Cassava Processor Revenue

Table 3 presents the results which indicate that cassava processing had a positive effect on the revenue of the adopters. This was not only positive but also significant at 1% significant level; also, the coefficient of the potential outcome mean was significant at 1%. The result implies that the effect parameter brought about ₦68,659.11 led to increase in the revenue of the adopters because they adopted the available technologies.

Table 3: Estimate of the Average Treatment Effect of cassava processing Technology

Adoption status	Coefficient	Std. Err.	Z	P>|z
Outcome (ATE)	0.2567	0.0801	3.20	0.002***
Outcome (Potential outcome mean)	0.5368	0.0809	6.64	0.000***

Source: Field Survey, 2021 *** significant at 1%, ** significant at 5%

Constraints faced by cassava processors

The result as presented on Table 4 showed that more than 90% of the respondents indicated that inadequate credit facility in the study area poses a serious threat to the improved cassava processing. About 70% posited inadequate infrastructure was severe in cassava processing. drudgery was another constraint identified by the respondents affecting cassava processing in the study area; this was evident as 99.37% of the respondents agreed that it was a major threat to the cassava processing in the study area. More than half (51.34%) of the respondents agreed that limited information on the technologies was another constraint to cassava processing, and more than 57% agreed that increased competition among processors also constitute problem to cassava processing in the study area. The result also showed the weighted score of each attitude and the mean score. Any constraint faced by respondents with a mean score greater or equal to 3 will be regarded to as disagree and a mean less than 3 will be regarded to as agree. Therefore, Inadequate credit facilities, Insufficient infrastructure, Drudgery, Limited information on the technologies, Increased competition among processors, High cost of machines, Bulkiness of cassava tubers, High cost of cassava tubers, Inadequate extension contact, High cost of transport, Bad access road, Long distance processing center, and Low level of education are the major constraints faced by the respondents in the study area.

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Table 4: Constraints faced by cassava processors in the study area

Variables/Statement	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Weighted score	Mean
Inadequate credit facilities	138(86.79)	13(8.18)	0 (0.00)	6 (3.77)	2 (1.26)	198	1.245
Limited supply of cassava	14(8.81)	25(15.72)	0 (0.00)	70(44.03)	50(31.45)	594	3.736
Insufficient infrastructure	44(27.67)	68(42.77)	1(0.63)	38(23.90)	8(5.03)	375	2.358
Drudgery	132(83.02)	26(16.35)	0 (0.00)	1(0.63)	0 (0.00)	188	1.182
Limited information on the technologies	42(26.42)	40(25.16)	2(1.26)	59(37.11)	16(10.06)	444	2.792
Increased competition among processors	41(25.79)	45(28.30)	0 (0.00)	57(35.85)	16(10.06)	439	2.761
High cost of machines	40(25.16)	50(31.45)	7(4.40)	51(32.08)	11(6.92)	420	2.642
Bulkiness of cassava tubers	35(22.01)	71(44.6)	3(1.89)	48(30.19)	2(1.26)	388	2.440
High cost of cassava tubers	35(22.01)	55(34.5)	2(1.26)	58(36.48)	9(5.66)	428	2.692
Inadequate extension contact	87(54.72)	58(36.4)	0 (0.00)	14(8.81)	0 (0.00)	259	1.629
High cost of transport	48(30.19)	62(38.9)	1(0.63)	41(25.79)	7(4.40)	374	2.352
Bad access road	76 (47.80)	58(36.4)	0 (0.00)	17(10.69)	8(5.03)	283	1.780
Long distance processing center	47(29.56)	65(40.8)	0 (0.00)	37(23.27)	10(6.29)	375	2.358
Age of the processor	10(6.29)	12(7.55)	1(0.63)	94(59.12)	42(26.42)	623	3.198
Low level of education	28(17.61)	21(132)	2 (1.26)	66(41.51)	42(26.42)	350	2.201
High cost of repair	8(5.03)	8(5.0)	6 (3.77)	79(49.6)	58(36.4)	648	4.075

Source: Field Survey, 2021

Conclusion

In conclusion, most of the respondents were still young and in their productive age. They were married and have a considerable moderate household size. Cassava processing technology adoption had impact on the revenue of the adopters. Inadequate credit facilities, insufficient infrastructure and high cost of machines are major constraints faced cassava processors in the study area.

Recommendation

Base on this findings, the following were recommended

I. It is therefore recommended that effort should be made to motivate processors through extension agents to embrace improved cassava processing technologies which will improve their production and increase their revenue.

ii. Cassava processors should have access to credit facilities in order to improve their level of Production

iii. Infrastructures should provide to the processor in order to make life better for them

iv. Government or NGO should make processing machine available to processors at affordable price

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