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Determinants of Cassava Output among Small Scale Farmers in Nigeria: A Survey of Akwa Ibom State Farmers

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Authors' contributions

All the authors collaborated to carry out the research. Author NEB was responsible for data collection and analysis. Author AJA designed the questionnaire, typed the manuscript and assisted in sourcing the literature and source the relevant literature while UIU proofread the final version of the manuscript.

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ABSTRACT

The study employed primary data collected through a multistage sampling technique from 90 respondents to examine the determinants of cassava output in Akwa Ibom State, Nigeria. Data were analyzed using Gross margin analysis, simple descriptive statistics as well as Ordinary Least Square (OLS) regression technique. Findings indicated that educated (75.6%), female (68.9%) farmers, majority who were within the age bracket of 31-40 years, with an average household size and mean farming experience of 6 and 10 dominated cassava production. The average Gross Margin and Net Income of N154,840 and ₦125,590 per hectare showed that cassava production was profitable. The study further showed that educational level, farm size, household size, farming experience, labour, and extension visit significantly influence cassava output in the study area. Also, high cost of cuttings and other inputs, high cost of labour, uneconomical size holdings, inadequate finance and storage facilities constituted the main cassava production problems in the study area. This informed the need for the government to give subsidy in the form of basic farm inputs to farmers, pursue policies that would enhance access to land, provide storage facilities and extension advice as well as encouraging farmers to take up cassava farming as a profitable venture in the study area as the way out.

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1. INTRODUCTION

The need to boost cassava production as a means of increasing food supply and reducing rural poverty have continuously been advocated [1,2,3,4],especially in sub-Saharan Africa where a significant proportion of the rural population is food insecure and malnourished [5], where the attainment of food security is intrinsically linked with reversing agricultural stagnation and safeguarding the National resource base [6].

Cassava is one of the important staples that is grown throughout the tropics and consumed by almost every household and is often intercropped with other crops. It is believed to be cultivated by small scale farmers with poor resources [7]. Its superiority over other staples arises from its ability to thrive well and yield exceedingly under average soil conditions and its high tolerance to adverse environmental conditions such as droughts and highly acidic soils. Fresh cuttings from matured cassava plants are often planted and the crop does well in a well drained soil with enough moisture. Matured plants are harvested from 7 months after planting and most varieties attain maximum yield at about 18 months after planting. However, improved varieties can be harvested from 6 months and attain maximum yield between 9-12 months after planting. As reviewed by [8], the crop has a standard recommended plant density of 10,000 plants/ ha with its major disease being the Mosaic virus. Fertilizer use by cassava farmers is low in Africa, a total supply of 165-25-145 Kg N-P-K per ha is recommended to attain 50 percent of the potential yield of 45 tons/ ha fresh roots. Cassava yield in Thailand and India are three times higher than in Africa and production cost in Brazil is one third that obtained in Africa.

Production wise, Nigeria is the leading world producer of cassava with annual output of 34 to 37.9 million tons [9]. Its production increased from 31,404 million tons in 1995 to 33,379 million tons in 2004 [10]. Between 2006 and 2008, Nigeria produced an average of 44,571,000 million tons [11]. This increase in cassava production is attributed among others to the cassava seed multiplication program, the root and tuber expansion program supported by IFAD as well as the input expansion policy of the government in cassava industry, where improved cassava varieties were given to farmers as inputs [2]. It can also be attributed to the introduction of new varieties and chemical/ organic manures [11], the joint efforts of African leaders through the New Partnership for Africa's Development as well as the intensified research efforts of research Institutes such as; the National Root Crop Research Institute (NRCRI) at Umudike, Abia State, and the International Institute of Tropical Agriculture (IITA), Ibadan in Oyo State as well as the Root and Tuber Expansion Programme supported financially by International Funds for African Development (IFAD). In terms of yield, [12] reported that Nigeria is rank low relative to Brazil, Thailand and Indonesia who are major producer of cassava after Nigeria with average yield per hectare of 10.8, 13.43, 16.8 and 12.02 tons respectively. Bulk of cassava produce is for consumption with little or no use in the agribusiness sector [13,14]. Despite containing cyanide, cassava is a good source of protein if supplemented with the amino acid methionine [15]. They are also consumed as vegetables [16,17]. [18,19] documented that 2/3 and 90 percent of the total cassava production in Nigeria is used as food for humans with lesser amount used for industrial purposes and for livestock feeds. Beyond this, government introduced the Presidential cassava production initiative in 2002, whose aim was to use cassava production as an engine for economic growth of the nation. Under this scheme, inputs were supplied to farmers and access to extension services made available. Also, through partnership with research institutes, government encouraged research in cassava production, the result

which led to the evolution of low cyanide, high yielding, water and drought resistant varieties of cassava that are popular among Nigerian rural farmers today. To further sustain the initiative, government promulgated a law mandating bread producers to incorporate 10% and 90% of cassava and wheat into their production from January 2005. This initiative, coupled with increased demand for cassava and cassava based products for food, livestock feeds and export tend to exert undue demand pressure on its production, thereby creating a demand- supply gap. In spite of the aforementioned initiative, Nigeria cassava production is still left in the hands of poor small scale resource farmers using traditional low yielding varieties with low output and market values which invariably translate into low income. Consequently, Nigeria's production only account for 0.001 percent of the world export market [20]. Bridging the aforementioned gap calls for the evolution of more innovative techniques that would guarantee intensive production with minimal damage to the ecosystem and environment at large. Achieving this objective entails identifying empirically those factors that determine cassava production in the study area. This, therefore form the basis for the study.

2. MATERIALS AND METHODS

2.1The Study Area

The study was carried out in Akwa Ibom State, Nigeria. It has a total land mass of 7,246 square kilometers and estimated population of 3,920,208 million people [21]. The area falls within the humid tropics with two distinctive seasons (dry and wet seasons), with temperature of about 30^0C and lies between latitude 4^0 32^1 and 5^033^1 North and longitude 7^025^1 and 8^025^1 East. The State is agrarian and is well suited for the production of both permanent and arable crops due to her favorable climatic conditions. Majority of inhabitants are predominantly peasant farmers cultivating food and cash crops. They also embark on small, medium and large scale livestock production as well as in marketing of their products.

2.2 Sampling Procedure and Data Collection

The study made use of primary data that were collected through a multistage random sampling in 2013. First, three Agricultural Zones were purposively selected from the existing six where intensive cultivation of cassava is carried out. They were Oron, Eket and Uyo. Next, two Local government Areas were randomly selected from each of the three Agricultural Zones making a total of six. They selected L.G.Areas were Esit Eket and Onna L.G.A from Eket Zone, Itu and Uyo L.G.A from Uyo Zone, Mbo and Udung Uko L.G.A from Oron Zone. Beyond this, one village was randomly selected from each of the six Local Government Areas. Finally, 90 were selected from the list of registered farmers with the extension agents and administered with questionnaires in the ratio of fifteen per village.

2.3 Method of Data Analysis

Simple descriptive statistics (mean, frequency, percentages) were used to analyze the demographic characteristics of respondents. Gross margin and budgetary technique was used to measure the economic viability of cassava production. Lastly, multiple regression analysis was carried out to measure the influence of socio-economic variables on output of cassava in the study area.

The study empirical models are presented below:

(i) Gross Margin Analysis

$$GM = TR\text{-}TVC \quad . \quad . \quad . \quad (1)$$

$$NFI = GM\text{-}TFC \quad . \quad . \quad . \quad (2)$$

Where

GM is the gross margin
TR is the total revenue (total income realized from the sale of cassava)
TVC is the total variable cost (summation of all the variable cost of production)
NFI is net farm income
TFC is the total fixed cost

(ii) The Multiple Regression Model

In order to determine the effect of production variables on cassava output, the multiple regressions regression analysis was carried out. Of the four functional forms (Linear, Double log, Semi-log and Exponential) that were estimated, the linear model was chosen as the lead equation based on the parameter's economic, statistical and econometric significance such as R^2, standard error values etc.

The implicit form of the production function analysis for cassava production in the study area is implicitly stated as follows:

$$Y = f(X_1, X_2, X_3, X_4, \ldots, X_{10}, + U) \quad . \quad . \quad . \quad (3)$$

Where

Y = output of cassava (Kg),
X_1 = Educational level of farmers (years)
X_2 = Farm Size (hectares)
X_3 = Household size (number),
X_4 = Farming Experience (in years),
X_5 = labour (mandays)
X_6 = Age of farmers (years)
X_7 = Fertilizer (Kg)
X_8 = Extension visit (number of times)
X_9 = Quantity of cassava cuttings planted (in kg)
X_{10} = Gender of farmer (female = 1 otherwise 0)
U = error term

The model can be stated explicitly as:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \ldots b_{10}X_{10} + U \quad . \quad . \quad (4)$$

Where

$b_1 \ldots b_{10}$ are coefficients to be examined and
$X_1 \ldots X_{10}$ are the explanatory variables defined in equation (1) above

3. RESULTS AND DISCUSSION

3.1 Demographic Characteristics of Respondents

From Table 1 which shows the socio-economic characteristics of respondents, the dominant age group was 31-40 years (44.4%), followed by 41 and above (33%) before 0-30% years (17%). This showed that farmers were at their youthful age. Experience wise, farmers were quite experienced with average experience of 9.5 years. 53.3% had between 1 and 5 years experience, 30% had between 6and 10 years experience while 16.7% had over 10 years of experience. This is likely to impact positively on cassava production as experienced have been found to enhance the use of improved technology [2]. Also, experience people are believed to have learned through several years of trials and errors. Gender wise, a higher percentage (68.91%) were female. This might be attributed to increased advocacy for women involvement in agriculture. Also, 48.9% had a household size of 5-10, followed by 35.6% who had a household size of less than 5 while 15.5% had a household size of 6-10 with an average household size of 6. This indicated the prevalence of abundant labor for cassava production in the study area. As for finance, a greater percent of farmers (55.6%) financed their cassava production through their personal savings, 41.1% borrowed from friends and relatives while 3.3% financed through banks and other financial institution. This is capable of impacting negatively on the adoption and use of improved varieties of cassava and other inputs. Educationally, majority (75.6%) were literate.32.2% attended primary school, 43.4% attended secondary school while 24.4% had no formal education. None of the sampled farmers attended post secondary school. This high literacy rate is capable of impacting positively on cassava output. Lastly, numerous respondent (53.35%) used hired labor, 35.6% used family labor while 11.1% made use of borrowed labor. This is surprising given the high household size prevalence in the study area. This, therefore, shows that the large household size in the study area maybe involve in other economic activities like off-farm work, rather than cassava production and is likely going to increase the cost of cassava production in the study area.

3.2 Average Costs and Returns in Cassava Production in the Study Area

The average cost and return of cassava farmers in the study area is presented in Table 2. From the Table, average total revenue from cassava output is ₦ 209,350 with a total cost of ₦ 121, 060. Variable cost accounted for 75.83 percent of total cost of production while fixed costs constituted 24.17 percent. Of this, labor cost constituted 67.09 and 50.89 percentages of the total variable cost and total cost of production respectively. Beyond this, farmers had a Gross margin (GM) and Net profit of ₦154, 840 and ₦125, 590. Hence, it can be inferred that cassava production was profitable in the study area. In Savannah and Rainforest Zone, [22] reported that labor cost accounted for 85.6 and 86.3 percent of cassava production cost.

Table 1. Demographic characteristics of cassava farmers

Variable	Number	Frequency
Age		
0-30	17	18.9
31-40	40	44.4
41 and above	33	36.7
Farming experience		
Less than 5 years	48	53.3
5-10 years	27	30.0
Above 10 years	15	16.7
Educational background		
No formal education	22	24.4
Primary	39	43.4
At least secondary	29	32.2
Gender		
Male	28	31.1
Female	62	68.9
Household size		
Less than 5	44	48.9
5-10	32	35.6
Greater than 10	14	15.5
Sources of Finance		
Personal savings	50	55.6
Friends and Relatives	37	41.1
Cooperative Society	3	3.3
Labour Source		
Family Labor	32	35.5
Borrowed Labor	10	11.1
Hired Labor	48	53.5

Source: computed from field survey data, 2013.

3.3 Factors Affecting Cassava Output in the Study Area

In assessing the factors affecting cassava output in the study area, four functional forms (linear, semi-log, double log and exponential) were estimated. Of these, the linear model was chosen as the lead equation due to the high R^2 value, the significance number of explanatory variables and the conformity of estimates to a priori expectations.

The result presented in Table 3 revealed that the education coefficient was positive and significantly related to cassava output at the 10 percent level. Educated farmers can better understand and assimilate farming information than their illiterate counterparts. They are also high risk takers and dominate the early adopters' category. [23] reported that they are more efficient in the use of productive resources to maximize output, presumably, due to their enhanced ability to acquire technical knowledge. This finding corroborated that of [24].
The coefficient for farm size was positive and significantly related with cassava output at the 10 percent level. This can be attributed to economy of scale, since large hectare would translate to increased production area. Other studies such as [25,24,23] reported similar results.

Table 2. Income and Expenditure by Cassava farmers per Hectare

Items	Units	Value (₦)
Revenue items		
Sales of cassava tubers	(bags)	191,200
Sales of cuttings	(bundles)	18,150
Total Revenue		**209,350**
Cost items		
(i) Variable cost		
(a) Labour		
Clearing	(mandays)	18,500
Planting	(mandays)	9,700
Fertilization	(mandays)	5,100
Weeding	(mandays)	28,300
(a) Cost of cuttings	(Bundles)	11,810
(b) Transportation	(₦)	16,800
(c) Cost of empty bags	(₦)	1,600
Total variable cost		91,810
(i) Fixed Cost		
(a) Land		26,000
(b) Depreciation		3,250
Total Fixed Cost		29,250
Total Cost (TVC+TFC)		121,060
Gross Margin (TR-TVC)		154,840
Net Income (GM-TFC)		125,590

Source: Computed from field survey data, 2013. Note: ₦160 is equivalent to 1 US $

Household size also impacted positively on cassava output at the 10 percent level of significance. Large household size could imply abundance labor for cassava production. This is the case since cassava production is labour intensive and is done manually because the scattered and fragmented land holdings in the study area does not favor mechanized farming. This finding is at variance with [24] reported negative relationship between household size and cassava output.

Farming experience was positive and significantly related to cassava output at the 5 percent level, meaning that cassava output increases with farmer's experience. This is in line with apriori expectation because, experienced farmers are known to be early adopters of agricultural innovations due to first hand information gotten from extension agents and hence, enhanced their productivity levels. This finding is in line with [2,26,23].

The coefficient for labor was positive and significant at the 5 percent level, implying that availability of labor would increase cassava output in the study area. Since cassava production is labor intensive farmers rely heavily on manual labor for their farming operations. This finding lends credence to those of [24,25,27]. However, other studies such as [28,29] also reported a positive relationship between labor and output of arable crops. Also, [23] reported a positive significant relationship between cassava production efficiency and labor.

Extension visit was positive and significant at the 10 percent level. The plausible explanation to this is that, since extension agents bridge the information gap between farmers and research institutes, farmers who have constant access to them are bound to be equipped with first hand information regarding new farming practices and techniques and, hence, improve upon their efficiency and output. This result complements that of [25].

The R^2 value of 0.897 implied that about 89.7 percent of the total variability in cassava output is explained by the explanatory variables in the model.

Table 3. Result of the multiple regression analysis/ production function analysis

Coefficient/variable	Linear (A)	Semi-log	Double-log	Exponential
Intercept	4471.068	-47681.641	-4.9378	9.9071
	(0.9621)	(1.3426)	(1.9532)*	(2.8359)**
Educational level	1273.302***	0.3414***	0.7643**	-1.704E-02
	(3.0961)	(2.406)	(2.243)	(-!.061)
Farm size	20605.071***	-2.1586	0.9731***	-1.7621
	(7.2294)	(-1.0060)	(4.7423)	(-0.407)
Household size	506.6980**	1697.32	0.1830	0.0502
	(2.9553)	(1.1562)	(0.2900)	(0.0382)
Planting material	-0.0562	0.0372	0.03519	-578.4732
	(-0.0875)	(0.4531)	(0.4337)	(-0.7206)
Farming experience	5835.172**	267.6180	-0.9531***	0.0739
	(2.0659)	(0.8321)	(-11.7667)	(0.7912)
Labor	17.6127**	0.3610***	0.4322	2.852E-03***
	(2.1599)	(4.3442)	(0.7024)	(3.2413)
Age of farmers	-0.5392	-0.4334	-0.7672*	-0.0234
	(-0.2692)	(-2.231)*	(-1.9611)	(-0.0031)
Fertilizer	1763.117	-48.7116	0.0047	0.0071***
	(0.8328)	(0.1312)	(1.2368)	(6.4545)
Extension visit	4523.001***	1885.531***	3.271E-02	0.1441***
	(3.6912)	(3.3006)	(-0.40887)	(8.5065)
Gender of farmers	0.6342	0.3136	1.1649	-2.8652
	(0.2354)	(0.1143)	(0.791)	(-0.7302)
R^2	0.897	0.793	0.843	0.697
Adj. R^2	0.875	0.765	0.822	0.651
Observations	90	90	90	90

*Source: field Survey, 2013. N/B, figures in brackets are standard errors. *** Significant at 1%,**significant at 5%, and *significant at 10%. (A) is the lead equation.*

3.4 Prevailing Cassava Production System in the Study Area

In terms of the prevailing production system in the study area, Table 4 showed that greater percentage (78.9%) of cassava farmers practiced mixed cropping, while 21.1 percent cultivated cassava as a sole crop. The major crops intercropped with cassava in the study area were yam, maize, pumpkin and cocoyam. Studies such as [30] highlighted the benefits of intercropping to include insurance against crop failure, providing better and efficient utilization of labour resources.

Table 4. Cassava production system in the study area

Production system	Frequency	Percentage
Mono cropping	19	21.1
Mixed Cropping	71	78.9
Total	90	100

Source: Field survey, 2013.

3.5 Constraint to Cassava Production in the Study Area

In the course of the field survey for this work, attempt was made to find out the various challenges faced by farmers in the study area; farmers were asked to rank their challenges in the order of severity. Among the identified challenges as shown in Fig. 1, high cost of cuttings and other inputs ranked first with 44%. The implication of this high cost of inputs and cuttings is that the overall cost of cassava production in the study area will increase. This invariably will reduce the gross margin as well as the net farm income of the cassava farmers. High cost of labor was ranked second (20.0%), uneconomical land holdings (17%) and inadequate storage facilities (11.1%). The high cost of labor in the study area, irrespective of the large household size is an indication that majority of the household members are engaged in other economic activities rather than farming. This finding contradicts [2] who documented a lower labor cost in cassava production in the study area.

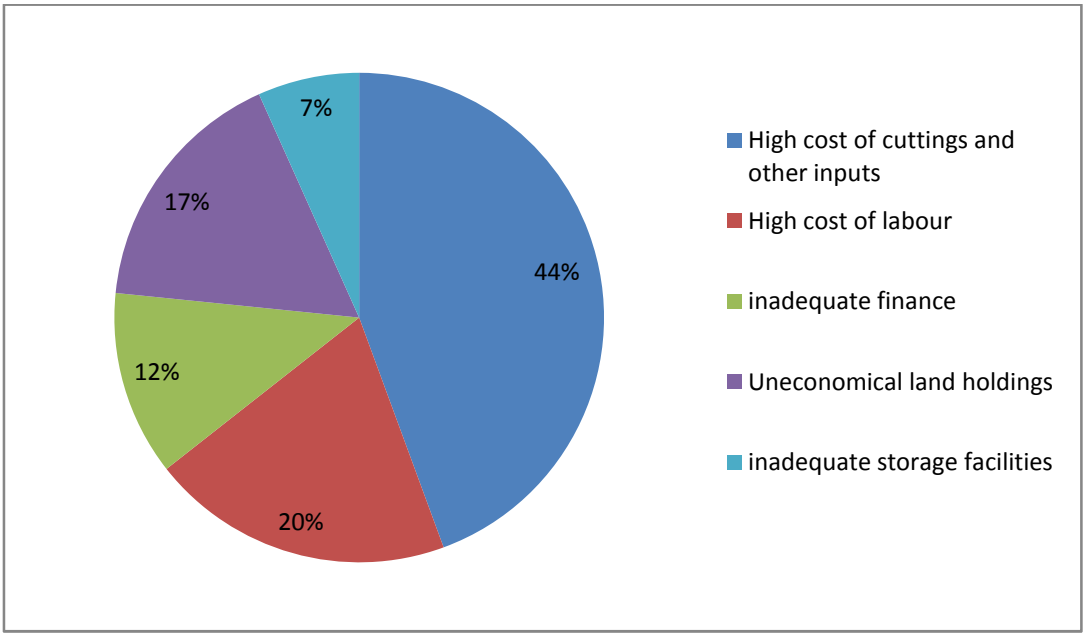

Fig. 1. Challenges faced by Cassava farmers in the study Area

4. CONCLUSION

The study assessed the socioeconomic factors affecting cassava output in the study area. Result revealed that cassava production is dominated by young (44.4%), female farmers (68.9%), majority whom were literate (75.6%) with average years of experience and

household size of 9.5 and 6 persons respectively. The study further revealed that cassava production in the study area was profitable with a gross margin of ₦ 154,840 and net income of ₦125, 590. In addition, the study showed that educational level, farm size, household size, farming experience, labour, and extension visit significantly influence cassava output in the study area. Beyond this, high cost of cuttings and other inputs, high cost of labour, uneconomical size holdings, inadequate finance and inadequate storage facilities constituted the main cassava production problems in the study area. The prevailing cropping pattern in the study area was mixed cropping.

5. RECOMMENDATIONS

Based on the findings of the study, the following policy recommendations evolved:

(i) Subsidies in the form of farm inputs like planting material, agro chemicals, fertilizers etc should be given to cassava farmers. This would go a long way to reduce their production cost per hectare of cassava to the barest minimum and enhanced their profitability level.
(ii) To address the land fragmentation problem, government can acquire large expanse of land and lease out to cassava farmers at reduced rate. This approach would enhance access to land and reduces the land rental value. The abandoned lands of the defunct River Basin Development Authorities lying idle in most States of the federation can serve this purpose.
(iii) Storage facilities should also be provided in the study area to reduce the rampant incidence of post harvest loses.
(iv) People should be encouraged through series of awareness campaigns to take up cassava production as a profitable venture. Apart from providing start-up capital for unemployed youths and young school leavers, other incentives like grants and guarantee schemes should be evolved and made available to cassava farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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