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Economic Analysis of Cassava Mixed Farming Enterprises in Epe Local Government Area, Lagos State, Nigeria

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ABSTRACT

This study investigated the economic potentials of cassava based farming in Epe Local Government Area of Lagos State, Nigeria. Primary data were collected with the aid of structured questionnaire and focus group discussion from 120 cassava farmers selected using multistage sampling technique. Data were analysed using descriptive statistics, gross margin analysis and multiple regression analysis. The results revealed that cassava farming households in the study area were dominated by small scale farmers who are predominantly male (68.33%) with mean age of 41.72 years. Though all crop combinations (i.e. cassava/maize, cassava/cocoyam, cassava/vegetable, cassava/cowpea, cassava/maize/melon, cassava/maize/vegetables and cassava/maize/melon/okra) were found to be profitable; cassava/maize mixed cropping enterprise was the most profitable with net farm income of ₦10,598.29 per hectare. The age of farmers ($p<0.05$), experience ($p<0.01$), educational level ($p<0.05$), cassava cuttings ($p<0.05$) and farm size ($p<0.10$) were the major determinants of output from cassava based mixed cropping production in the study area. About 66.67%, 54.17% and 51.67% of the farmer indicated that high cost of land, poor crop yield and high transportation cost were the major constraints facing cassava based farmers in the study area. It was therefore recommended that efforts should be made by government to review the cost of acquiring arable lands; make available improved cassava cuttings and also provide good roads in order to increase the level of cassava-mixed production in the study area.

Key words: Economic analysis, cassava-mixed farming, mixed cropping, Lagos State, profitability

INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is a well-known root crop which originated from South and Central America and was introduced into Africa in the 16th century (FAO, 2005). 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 (Bassey *et al.,* 2014). The crop can easily adapt to different climatic and soil conditions, hence its ability to grow and be available all year round, which gives it advantage over other tuber crops like yam, cocoyam and potato. Cassava products are generally accepted by all classes of Nigerians, which makes it attractive to farmers (Itam *et al.* 2014). The crop and its derivatives have excellent potentials in livestock feed formulation, textile industry, plywood, paper, brewing, chemicals, pharmaceutical and bakery industries (Sanni, *et al.,* 2008) It is an important source of dietary carbohydrate and provides food for over 60 million people in Nigeria (Adebowale *et al.,* 2008).) The roots are processed into garri, fufu, tapioca, chips and cassava flour for human consumption (Sanni *et al.,* 2008; Adebowale *et al.,* 2008). The leaves are edible while the roots are also a good source of ethanol and are rich in minerals, vitamins, starch and protein (Adegbola *et al.,* 1978; Ravindran, 1992). It is believed to be predominantly cultivated by small scale farmers with poor resources (Ezebuiro *et al.* 2010).

Cassava gained prominence in Nigeria following the pronouncement of a presidential initiative on the crop. The initiative was aimed at using cassava production as the engine of growth in Nigeria. Consequently, Nigeria has become the leading world producer of cassava with annual output of 34 to 37.9 million tons (Awoyinka, 2009). Its production increased from 31,404 million tons in 1995 to 33,379 million tons in 2004 (FAO, 2005). Between 2006 and 2008, Nigeria was reported to have produced an estimated average of 44,571,000 million tons (FAO, 2009). This increase in cassava production was attributed to the cassava seed multiplication programme, the root and tuber expansion programme supported by International

Fund for Agricultural Development (IFAD) as well as the input expansion policy of the government in cassava industry, where improved cassava varieties were given to farmers as inputs (Bassey and Okon, 2008). It can also be attributed to the introduction of new varieties and chemical/ organic manures (FAO, 2009). The Nigerian government promulgated a law, making it compulsory for bakers to use composite flour of 10 per cent cassava and 90 per cent wheat for bread production. The regulation, which came into effect, January 2005, stipulated that the large flour mills that supply flour to bakeries and confectioneries must pre-mix cassava flour with wheat flour.

The extensive practice of cassava mixed cropping system could provide a means of improving the lots of cassava famers. Cassava mixed crop system involves the cultivation of two or more crops on the same piece of land with cassava as the base or main crop. The effective utilization of this system of cassava production will help insure the farmers against heavy economic loss (Odurukwe *et al.,* 1996). Obayelu, *et al.* (2014) studied the relative profitability of cassava mixed cropping system and reported that cassava/cowpea enterprise had the highest net margins of ₦127,249.63/ha and ₦122,325.73/ha in Ogun and Oyo States respectively. In another study, Bamiro *et al.* (2012) revealed that cassava/maize/vegetable production enterprise is the most profitable with net farm income of ₦36,649.90/ha. Given the comparative advantage associated with the cassava-mixed cropping system which includes: high gross returns per unit area of land, high yield stability and less risk, better control of pests, diseases, weeds and erosion and most importantly the more efficient use of resources such as land and labour, farmers could maximize yield as well as profit (Ibeawuchi *et al.,* 2002).

Thus, it is expected that the adoption of the cassava mixed cropping system could improve the welfare of the farmers and consequently lead to a reduction in their poverty level and food insecurity. This is however not always the case as cassava farming are usually on small-scale which are characterized by very low productivity, over-reliance on household resources, labour-intensive agricultural technology and rapidly declining soil fertility, leading to low yield (Likita, 2005; Fakayode *et al.,* 2008). Moreover, efforts at improving agricultural production have always been concentrated on increasing production through the breeding of high yielding varieties with little emphasis on profitability of production output and conservation of what is produced (Offor *et al.,* 2010). This study therefore aimed at analysing the economic potentials of cassava mixed cropping system in Epe Local Government Area, Lagos State, Nigeria. The specific objectives of the paper are to: examine the socio-economic characteristics of the respondents, determine the profitability of cassava based mixed cropping production in the study area, identify the factors influencing the output of cassava based mixed cropping and constraints militating against cassava based mixed cropping production in the study area.

METHODOLOGY

The study was carried out in Epe Local Government Area of Lagos State, Nigeria, located on coordinate 6°35'N 3° 59'E in the northern side of Lekki Lagoon. The area is within the humid tropical rainforest vegetation zone of south-western Nigeria and covers about 3,474 km^2 with mean annual rainfall of 2000-3000 mm. Based on 2006 census; population in Epe LGA was 9,019,534 (NPC, 2006). The people in the area are predominately farmers growing food crops such cassava (which is the most common), vegetables, plantain, banana, etc. The people of the area are also popularly known for fish farming.

Multistage sampling technique was employed in this study. The first stage was the purposive selection of Epe LGA from the all the LGAs in Lagos state for ease of data collection. The second stage involved the purposive selection of Eredo Local Council Development Area (LCDA) from the three LCDAs in Epe LGA. Eredo LCDA was purposively selected because of the prevalence of cassava mixed cropping system in the area. In the third stage, 12 communities were randomly selected from 18 communities using the list of communities as a sampling frame. The fourth stage involved the simple random selection of 10 cassava farmers from each of the selected communities making a total of 120 farmers for this study. Data were collected with the use of structured questionnaires and focus group discussion to obtain information on farmers' socio-economic variables, cost of inputs, and output size for 2016 farming season.

Analytical procedure

Descriptive statistics such as mean, frequency and percentage were used to describe the socio-economic characteristics of the respondents as well as the constraints facing cassava farmers in the study area.

Gross margin analysis was used to determine the profitability of cassava mixed crop farming in the study area. The gross margin was represented by:

$$G.M = TR - TVC \quad (1)$$

$$NFI = GM - TFC \quad (2)$$

Where
G.M = Gross margin
TR = Total Revenue
TVC = Total variables cost
NFI = Net farm income
TFC = Total fixed cost

Multiple regression analysis was employed to determine the factors influencing the output of cassava mixed cropping system the study area. The functional relationship is given as:

$Y = f(X1, X2, X3, X4, X5, X6, \varepsilon)$ (3)

Where

Y= Cassava output (kg)
X1 = Age of the farmer (years),
X2= Household size (no of people)
X3 = Farming experience (years)
X4 = Educational level of farmers (years of formal schooling)
X5 = Cassava cuttings (bundles)
X6 = Enterprise combination (number)
X7 = Farm size (ha)
X8 =Labour (manday)
ε = Error term

Four functional forms of the regression model (linear, semi log, exponential and double logarithm) were fitted for the purpose of selecting the best equation which was chosen based on the number of significant variables, coefficient of determinations (R2), the sign of coefficients and F value.

RESULTS AND DISCUSSION

Socio-economic characteristics of Cassava farmers in the study area

Table 1 presents the socio-economic characteristics of cassava farmers in the study area. The result showed that 68.33% of the farmers were male while 31.66% were female. This implies that cassava mixed cropping in Epe LGA was dominated by male. The age distribution showed that larger percentages (40%) of the respondents were within 41-50 years age range. The mean age of respondents of 41.67 years implies that the respondents were within the economically active age group which has positive correlation with acceptance of innovation and risk taking (Iheke and Oliver-Abali, 2011). Cassava farmers that had no formal education accounted for 15.83% of all the total farmers while the remaining 84.17% had formal education ranging from primary to tertiary education. This implies that respondents are relatively educated, which might have positive consequences on their capacity to exploit latent opportunities in the cassava mixed farming and also support them in the adoption of improved technologies. This was corroborated by Bassey *et al.* (2014), who opined that high literacy rate is capable of impacting positively on cassava output. The results revealed that 25% of the respondents had between 1-10 years cassava mixed farming experience, 43.33% had between 11-20 years while 31.67% of the farmers had more than 20 years of mixed farming experience. The mean farming experience in the study area was 12.52years. This implies that the farmers are well experienced in cassava mixed cropping system. Aminu and Hassan (2016) observed that higher farming experience of the farmers reduces management risks and crop failures. The mean farmers' household size of 8 people implies that cassava farmers in the study area have large household size. This imposes a high economic cost burden on the members of the household. Though a large family size may constitute a social burden, larger families use their labour input to an advantage in farming. Close to half (45.83%) of the respondents cultivated between 0.5 and 1 ha of land, 12.5% cultivated between 1 and 1.5 ha while 5% cultivated more than 1.5ha of land. The mean farm size of 0.63 ha implies that the cassava farmers in the study area were operating on a small-scale level. Babatunde (2004) classified the farm sizes of 0.01-1.0ha, 1.1-2.0ha and above 2.0ha as small, medium and large farms, respectively. The study also reveals that 47.50% of the respondents employed family labour on their farms while 34.17% employed hired labour. The mean income size of ₦22,103.52 per hectare per cropping season is small probably because the farmers operated at small-scale level. Bamiro *et al.* (2012) reported a mean income of ₦55,422.132 per hectare in a similar study conducted in Ogun State. Furthermore, 65.83% of the respondents do not belong to cooperative association. This could impact negatively on their credit mobilisation ability.

Enterprise Combination of Cassava Based cropping system in the Study Area

Table 2 presents the enterprise combination of the respondents. According to the respondents, mixed cropping systems are the best production system that maximizes their output per land area. It was evident from the results that most of the respondents engaged in simple mixtures under the cassava mixed cropping system which consists of only two crops with cassava as the main crop. The cassava mixed cropping practiced by farmers in the study area include: cassava/maize (28.33%), cassava/cocoyam (15%), cassava/vegetables (17.50%) and cassava/cowpea (15%). Also, the practice of complex crop mixtures, which consists of three, four or more crops with cassava as the main crop was observed in the study area. These include: cassava/maize/melon mixtures (9.17%), cassava/maize/vegetables mixtures (12.5%) and cassava/maize/okra/melon mixtures (2.5%). This result is in consonance with those of Fakayode *et al.* (2008) who reported that the prevalent cropping practices among cassava-based production system in Kwara state were cassava/cowpea (12.5%) cassava melon (23.7%), cassava/maize (35%) and cassava/maize/guinea corn (28.8%). The result also agrees with those of Herbert and Onoja (2010) and Bamiro *et al.* (2012).

Table1: Distribution of respondents by socio-economic characteristics

Variable	Frequency	Percentage	Mean
Gender			
Male	82	68.33	
Female	38	31.66	
Age (years)			
20-30	5	4.17	
31-40	27	22.5	
41-50	48	40	41.67
51-60	22	18.33	
Above 60	18	15	
Education (years of schooling)			
No formal education	19	15.83	
Primary education	35	29.17	
Secondary education	21	17.5	11.07
Technical/vocational	25	20.83	
Tertiary	20	16.67	
Farming Experience (years)			
01-Oct	30	25	
Nov-20	52	43.33	12.52
Above 20	38	31.67	
Household Size (No of people)			
01-May	23	19.17	
06-Oct	76	63.33	8.06
Above 10	21	17.5	
Farm Size (ha)			
<0.5	44	36.67	
0.5-1.0	55	45.83	0.63
1.0-1.5	15	12.5	
>1.5	6	5	
Labour Employed			
Family	57	47.5	
Hired	41	34.17	
Both	22	18.33	
Sales Outlet			
Market	71	59.17	
Farm	49	40.83	
Income /ha (₦)			
<20,000	11	9.17	
20,000-30,000	54	45	22,103.51
31,000-40,000	36	30	
>40,000	19	15.83	
Membership of Cooperative Association			
Yes	41	34.17	
No	79	65.83	
Extension Contact			
Yes	52	43.33	
No	68	56.67	

Source: Field Survey Data, 2016

Costs and Returns analysis of cassava mixed cropping system

The result of the costs and returns analysis for cassava mixed farming system is presented in Table 3. The result showed that, of the simple cropping mixtures engaged in by respondents in the study area, the mixture of cassava and vegetable incurred the least total cost of production of ₦11, 0422.99/ha. This was followed by cassava/maize mixture (₦15,406.81) while the cassava/cocoyam and cassava/cowpea mixtures incurred almost similar total variable costs of ₦20,900.3 and ₦20,985.97 respectively.

Of the complex cropping mixtures practiced in the study area, the cassava/maize/vegetable mixtures incurred the least total production cost of ₦20,093.49. This was followed by cassava/maize/melon which incurred production cost of ₦21,447.4 while the cassava/maize/melon/okra incurred the highest total production cost of ₦24,887.91. The results of net farm income revealed that cassava/maize enterprise had the highest net income margins of ₦10.598.29/ha, followed by the cassava/maize/melon/okra (₦10,202.31), cassava/maize/vegetable (₦9,827.96), cassava/maize/melon (₦9,545.67), cassava/cocoyam (₦7,864.95), cassava/cowpea (₦7,446.46) enterprises while the cassava/vegetables had the lowest return of (₦7,141.34). The result implies that cassava mixed cropping production system in the study area is profitable.

Table 2: Enterprise combination in the cassava mixed cropping system in the study area

Crop Combination	Frequency	Percentage
Cassava/maize	34	28.33
Cassava/cocoyam	18	15
Cassava/vegetables	21	17.5
Cassava/cowpea	18	15
Cassava/maize/melon	11	9.17
Cassava/maize/vegetable	15	12.5
Cassava/maize/melon/okra	3	2.5
Total	120	100

Source: Field study, 2016

The result further confirms that combining enterprises significantly increase farmers' income and help insure the farmers against heavy losses. This result is in accordance with those of Fakayode *et al*. (2008) and Bamiro *et al*. (2012). Bamiro *et al.,* 2012 reported in their study that combining three enterprises significantly generated the highest net farm income with cassava/ maize /vegetable enterprise giving the highest of about ₦36,649.99 per hectares, which is closely followed by combination of two enterprises of cassava/maize enterprise which gives net farm income of ₦36,462 while the least net farm income of ₦13,180 was from cassava/melon/vegetable enterprise.

Determinants of output from cassava based production

Table 4 gives the summary of the multiple regression analysis employed in estimating the determinants of output from cassava mixture production system in the study area. In estimating the production function, four functional model forms; linear, semi-log, exponential and double-log were fitted. However, the double-log model was chosen as the best because it had more number of significant variables which conform to the a-priori expectations, highest coefficient of determination (R^2) and significant F value. The F-statistics of 11.012 was significant at 1% level of significance attesting to the goodness of fit of the model.

The R^2 value of 0.631 showed that about 63% of the variation in output from cassava production is jointly explained by the socio-economic variables included in the model. The result presented in Table 4 revealed that output from cassava based production in the study area was significantly determined by age of farmers, their farming experience, their educational level, the bundles of cassava cuttings planted and the size of their farms.

The age of farmers involved in cassava production had a negative and significant relationship with cassava output in the study area at 0.05 alpha levels. This implies that output from cassava production decreases with the age of farmers involved in the enterprise. This result agrees with Iheke and Oliver-Abali (2011) that older farmers are more risk averse and hence, adoption of innovation decreases with age. A 1% increase in the age of the farmers will reduce cassava output by 0.361%The number of years of experience the farmers had, was found to have a direct significant ($p<0.1$) influence on cassava output. This indicates that the farmers are able to manage risks well with higher years of experience and therefore increase their output level. Furthermore, educational level of farmers was found to have a positive and significant ($p<0.05$) relationship with the farmers' output level. This implies that the higher the educational level, the higher the output realized from cassava production in the study area. This is because educated farmers understand and assimilate farming information better than their uneducated counterparts. Bassey *et al*. (2014) classified the educated farmers as high risk takers that dominate the early adopters' category. Also, the number of bundles of cassava cuttings planted by the farmers was found to be positive and significance at 5% level. This implies that output of cassava increases with the number of bundles of cassava planted in the study area. Lastly, the size of land cultivated by the farmers had a direct significant relationship with cassava output at 1% level.

Table 3: Average Costs and Returns analysis for Cassava based farm enterprises/Ha

Cost Item (₦)	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Cost of inputs	6345.02	9765.76	3641.98	8497.36	9855.08	8965.79	10054.41
Costs of transportation	585	986.21	453.65	435.81	687.43	603.43	1092.37
Cost of agrochemicals	4475.67	5632.1	4082	6875.02	5125.32	4863.28	7040.84
Cost of labour	3495.25	3894.33	2856.36	4632.14	5224.01	5060.24	6010.77
Total variable cost (TVC)	14900.94	20278.4	11033.99	20440.33	20891.75	19492.74	24198.39
TFC (depreciated)	505.87	621.9	388.98	545.64	585.65	600.75	689.52
Total cost (TC)	15406.81	20900.3	11422.97	20985.97	21477.4	20093.49	24887.91
Return							
Total Revenue	26005.1	28765.25	18564.31	28432.43	31023.07	29921.45	35090.22
Gross margin	11104.16	8486.85	7530.32	7992.1	10131.32	10428.71	10891.83
Net margin	10598.26	7864.95	7141.34	7446.46	9545.67	9827.96	10202.31

Source: Computed from field survey, 2016

A= cassava/maize, B= cassava/cocoyam, C= cassava/vegetable, D= cassava/cowpea, E= cassava/maize/melon, F= cassava/maize/vegetables, G= cassava/maize/melon/okra

Table 4: Determinants of output from cassava-mixed production

Variable	**Coefficient**	**T-value**
Constant	10.321 (0.674)	2.88
Age (X_1)	-0.361 (0.231)	-2.21**
Farming experience (X_2)	1.356 (0.67)	2.11**
Household size (X_3)	-0.031 (0.063)	0.67
Education (X_4)	0.025 (0.157)	3.52***
Cassava cuttings (X_5)	0.080 (0.166)	2.92***
Enterprise combination (X_6)	0.015 (0.231)	1.59
Farm size (X_7)	0.026 (0.152)	2.13**
Labour (X_8)	0.112 (0.101)	0.36
R^2	0.631	
Adj.R^2	0.499	
F-Stat	11.012***	
RTS	1.222	

****, ** indicate significance at 1% and 5% respectively;*

Values in parenthesis are standard errors of estimates.

Source: Computed from Survey Data, 2016

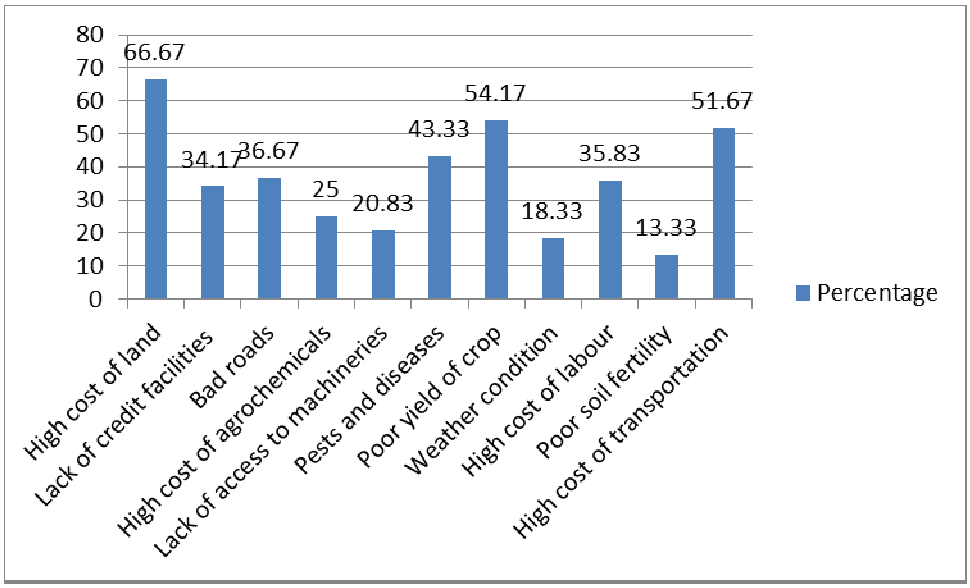

Figure 1: Constraints facing cassava farmers in the study area

This implies that increasing the farm size by one hectare will bring about 2.6% increases in output of the cassava farmers in the study area. This result is in line with those of Nandi *et al.* (2011); Itam *et al*. (2014) and Bassey *et al.* (2014) who reported a positive significant relationship between farm size and cassava output in their studies.

Return to Scale (RTS)

The Return to Scale (RTS) is defined as the sum of the elasticities that are associated with a certain production process. According to Yakasai (2010), the RTS measures the proportionate change in output if all the inputs are changed simultaneously by one percent. The RTS value for the function presented on Table 4 is 1.222. This indicates that cassava farmers in the study area were operating in the stage 1 of the production surface where there is an increasing return to scale. As such, a 1% increase in all the specified inputs will lead to about 1.2% increase in cassava output. In order to obtain higher output at this stage, the use of the inputs could be continued until the production capacity of such input would reach its optimal level. Other studies such as Oniah *et al*. (2008); Nandi *et al*. (2011) and Aminu and Ayinde, (2014) reported similar result in their studies.

Constraints Facing Cassava Farmers in the Study Area

Figure 1 presents the constraints faced by the cassava based farmers in the study area. The result reveals the major constraints as: high cost of land (66.67%), poor yield of crops (54.17%) and high cost of transportation (51.67%). Other problems are pests and diseases (43.33%). bad roads (36.67%), lack of credit facilities (34.17%), high cost of agrochemicals (25%), lack of access to machineries (20.83%), weather conditions (18.33%) and poor soil fertility (13.33%). The high value of each constraint is explained by the multiple responses given by respondents.

CONCLUSION AND RECOMMENDATIONS

Cassava mixed cropping production in Epe LGA was dominated by male with a mean age of 41.67 years who were relatively educated but were operating on a small-scale level. Cassava/maize enterprise was the prevalent mixed cropping enterprise in the study area. Cassava/maize mixed cropping had the highest net profit margins of ₦10.598.29, followed by cassava/maize/melon/okra (₦10,202.31), while cassava/vegetables mixture had the lowest return of ₦7,141.34. Output from cassava production was significantly determined by age of farmers, farming experience, farmer's educational level, bundles of cassava cuttings and farm size. The major constraints facing cassava farmers were high cost of land, poor yield of crops and high transportation cost. In conclusion, cassava mixed cropping production was found to be a profitable enterprise in the study area.

Consequently, farmers in the study area should be encouraged to practice cassava mixed cropping production with improved crop varieties as this will not only increase

their net farm income; it will also guarantee flow of income throughout the year. Also, farmers should form and join viable cooperative societies in order to mobilise rural savings that can be easily accessible by the farmers. Finally, concerted efforts should be made by government both at the state and federal levels to review the cost of acquiring arable lands; make available improved cassava cuttings and also provide good roads in order to increase the level of cassava-mixed production in the study area.

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