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Profitability of Cassava-based Production Systems

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ABSTRACT The study was undertaken to analyze the profitability of cassava-based production in Oyo State. The population for the study consisted of all small-scale cassava farmers in the State. A well-structured questionnaire was used to collect information from 120 randomly selected small-scale cassava farmers. Out of these, 110 pieces of the administered questionnaires were retrieved and analyzed. The finding showed that 72.7 percent of the farmers are male in their active average age of 38.95 years with 14.5 percent of the respondents having no formal education. The objectives of the study were to determine the cost, return and evaluate the profitability of cassava production in the study area. The business was found to be profitable with total revenue of ₦ 174,231.81k, average profit of ₦54,069.57k and gross margin of ₦62,449.11k per hectare. The analysis result revealed that net return of the farmers is affected positively by the use of fertilizer, price per cassava truck and the total revenue. On the other hand, cost of ridge making, cost of land clearing, cost of weeding, type of labor used, cost of feeding, cost of cassava stem cutting, and cost of transportation to point of sale were negative and significant to the net return. Also, the adjusted R^2 is 0.995 showing that 99.5 percent of the variability in the dependent variables is explained by the estimated independent variables. A stable and workable food policy was recommended to curb the technical and institutional constraints in cassava production.

INTRODUCTION

Cassava (*Manihot esculenta Crantz*) was introduced in central Africa from Brazil, South America in the sixteenth century by the early Portuguese explorers. It was probably the emancipated slaves who introduced cassava into the southern part of Nigeria, as they returned to the country from South America through the islands of Sao Tome and Fernando Po, which were Portuguese colonies off Nigeria's shores at that time. It is a staple crop that is mostly grown in many tropical countries of Africa, Asia and Latin America (Ohadike 2007).Cassava did not become important in Nigeria until the end of the nineteenth century when processing techniques were introduced, as many more slaves returned to their motherland.

Cassava is a root tuber being cultivated in rainforest and derived savannah zones of Nigeria. It is one of the most important staple food crops in sub-Saharan Africa, and its average consumption exceeds 300 kg per person annually in some areas of Africa. Its hardy, nature gave it a better edge over other arable crops of the tropic (Odoemenem 2011). Compared to other tropical crops, cassava is more tolerant to poor soil fertility, it is drought resistant, hardy to pests and diseases. More so, its roots are storable in the soil for months after they mature (without getting spoiled).

These attributes combined with other demographic and economic considerations are therefore what IFAD recognized in the crop as lending itself to a commodity-based approach to poverty alleviation (FAO 1995). Cassava as a staple food crop has some inherent characteristics which make it attractive, especially to the rural subsistent farmers in Nigeria in that it is rich in carbohydrates especially starch and consequently has a multiplicity of end users. It has poor protein and other nutrients though its leaves are a good source of protein if supplemented with amino acid methionine despite cyanide contained (FAO 2003). It is available all year round, which makes it preferable to other more seasonal crops like grains, beans and other staple crops for food security.

Furthermore, cassava is important in all spheres not only as a food crop but even as a major source of income for rural household farmers. Nigeria is currently the largest cassava producer in the world with an annual production of over 34 metric tons a year (Raphael 2008). Cassava is highly consumed in processed forms in

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almost all parts of Nigeria. Its use in industry and livestock feed, is well recognized, but is gradually increasing especially as import substitution becomes prominent in the industrial sector of the economy. As a cash crop, the export drive for the crop increased the demand for cassava and promoted its cultivation (CBN 2004). Cassava generates cash income for the largest number of farming households in comparison to other staple food crops. It is produced with relevant purchased inputs as often as and in some cases more frequently than other staple food crops.

More so, a large proportion of total production that is probably larger than that of most staples counterparts by rural farmers is planted annually for sale and the households' immediate consumption. It is a latex-producing crop, which reaches a height of 1.8 to 3.6 meters, depending on the variety propagated. Cassava is cultivated for its tuberous roots, from which cassava flour, breads and tapioca are derived. It is in demand for several reasons, as (Oloyede 2004) it is used to feed livestock, and the root tuber is very important raw material in *gari* (Cassava powder) production, ethanol and industrial starch pellets.

According to FAO (2005), the world production of cassava was estimated to be 184 million tons in 2002, majority of production came from Africa where 99.1 million tons were grown, followed by Asia where 51.5 million tons were grown and the rest 33.4 million tons in Latin America and the Caribbean. Cassava is primarily produced and processed for sale as a cash crop in urban areas and foreign markets. For a nation to move to this stage, the technological requirements are high yielding varieties as well as early bulking that can be harvested at 12 months and mechanized processing tasks (Nweke 2004).

The fuels that drive the transformation include development and dissemination of high yielding cassava varieties. This variety increased demand for cassava and the favorable government policies. The transformation however, introduced bottlenecks, which were broken so as to transform cassava from a rural and urban cash crop to play additional roles as livestock and industrial raw materials (Nweke 2004). According to IFPRI (2000), urban agriculture can have a beneficial impact on food security for low-income urban residents. The recent development on cassava has also shown that it has been changed from being a mere subsistent staple crop to an industrial cash crop.

Cassava is making a sporadic wave among other agricultural produce and as one of the most actively marketed staple food crops and is the most promising in terms of growth and new market opportunities. There is also a regular abundance of cassava in most producing countries and several governments in Africa have taken positive steps to promote cassava production for industrial use since many of these countries have comparative advantage in cassava production thereby producing on a large scale. Although, several new varieties of cassava were recently introduced to farmers after several on-farms testing in several locations (IITA 2005).

Most recent releases such as TMS 50395 and TMS 30572 were doing much better in the farmers' fields than earlier release. These imply that the current policy direction of the federal government of Nigeria has encouraged cassava development leading to a call for new orientation in the research-extension-farmers linkage (Asogwa et al. 2005). It is also observed that the input expansion policy of the government in the cassava industry through the provision of improved cassava varieties and improved processing technology leads to efficient use of resources in cassava production in Nigeria.

However, Oni (2003) explained that the level of adoption of the improved technologies is low as improper application of some of the technologies are also ripe among rural farmers and this could be attributed to the disconnect between the research-extension-farmer chain. According to Ezebuiro et al. (2008), cassava is strongly believed to be cultivated by small-scale farmers with low resources, it also plays a major role in the effort to reduce the food crisis by raising the food security level especially in Africa. Nigeria's food security depends mainly on food production by small-scale farmers cultivating not more than 3 hectares of land that are usually scattered over wide areas of land, using poor technologies, which makes their output very low.

In spite of the countless policies implemented over the years to increase the farmers' productivity in cassava, low productivity has been the order of the day since majority of the rural farmers operate on small-scale, and this study finds it highly imperative to examine and analyze the costs and returns to cassava production thereby giving timely information to deci-

sion-makers to initiate assessments and influence the formulation of pertinent policies to help from this poor productivity threat. These studies describe the socio-economic characteristics of farmers, determine the major factors influencing cassava production among farmers, and estimate the profitability of cassava production in the study area.

MATERIAL AND METHODS

Study Area

Oyo state is one of the six southwest states of Nigeria with a total of thirty-three Local Government Areas (LGAs) .The topography is mainly plain to slightly gentle rolling lands. The study was conducted in the rural Orire local government area of the state, the total population in this LGA was 170,858 people and a 2040 km^2 land area (National Bureau of Statistics, 2009). It is located within longitude 8º1'N and latitude 3º 29'E with a mean annual temperature of 26.2º C, lowest temperature of 24.3ºC, while the highest temperature is 28.7º C and the mean annual rainfall is 1247 mm. The Orire Local Government Area is bounded by the Irepodun Local Government Area in the north, Oyo local Government area in the west, Ogo-Oluwa and Ogbomoso-South Local Government Area in the south and in the east by Ogbomoso North and Kwara state. The primary occupation of the inhabitants is farming, especially cultivation of food and cash crops due to the extensive fertile soil suitable for agricultural practice. Food crops grown in this LGA include cassava, vegetable, cowpea, yam and maize, while cash crops grown include cocoa, cashew, mango, pawpaw and citrus. Fruit crops such as banana, plantain, mango, pawpaw and pineapple can also be found in the area. The inhabitants are majorly Yoruba while other tribes such as Igbos, Hausa and Uhobo reside and practice farming in the area.

Sampling Technique

A four stage random sampling technique was adopted for this study. The first stage involved the random selection of an intensive agrarian local government area out of the thirty-three local government areas in Oyo State. The second stage was the random selection of six wards out of the 10 distinct wards in the LGA. These wards were purposively selected due to high number of small-scale farmers in the area. Furthermore, six villages were randomly selected (one from each selected ward) at the third stage while there was a random selection of twenty small-scale cassava farmers from each of the villages to make up a sample size of 120 at the fourth stage. However, only 110 questionnaires were properly filled and worth being analyzed for the research.

Analytical Technique

Descriptive, inferential statistics and gross margin analysis were used in data analysis. Descriptive instruments like tables, percentages, frequency distribution where used to explain the socio-economic characteristics of the respondents while regression analysis was employed for testing the hypothesis (Ogolo 1996). The gross margin analysis was carried out to measure the profitability of cassava production. According to David and Stanley (2000), gross margin is measured as Total Revenue (TR) less Total Variable Cost (TVC). The net return (Profit) was calculated by subtracting the Fixed Cost (FC) from Gross Margin (GM).

Mathematically:

$TC = TFC + TVC$

$GM = TR - TVC$

$NR/PROFIT = GM - TFC$

Where,

GM = Gross Margin

TR = Total Revenue

NR = Net Return

TFC = Total Fixed Cost

TVC = Total Variable Cost (Fagoyinbo 1999).

The inferential analytical tool used was the Ordinary Least Square (OLS) on STATA 10 software. Regression analysis was used to identify factors affecting the cassava production (to test the hypothesis) and to determine the relationship between the dependent and independent variables thereby revealing the overall effect of all independent ones on the dependent variable. The model is given below:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} \ldots\ldots X_{17} + \varepsilon_0$$

(Koutsoyiannis 2003)

Where,

Y = Profit

X_1 = Cost of land rent

X_2 = Cost of ridge making

X_3 = Cost of land clearing

X_4 = Cost of weeding
X_5 = Cost of feeding
X_6 = Cost of cassava stem cutting
X_7 = Cost of transportation to point of sale
X_8 = Bargain cost
X_9 = Age
X_{10} = Year of education
X_{11} = Source of finance
X_{12} = Year of experience in cassava farming
X_{13} = Type of labor used
X_{14} = Use of fertilizer
X_{15} = Use of chemicals
X_{16} = Price per truck
X_{17} = Total revenue
Σ_0 = Error term
β_0 = Constant
β = Parameter

RESULTS AND DISCUSSION

Respondents' Socio-economic Characteristics

The statistical analysis of the respondents' demographic characteristics in Table 1 shows that 72.7 percent of the farmers were male while 27.3 percent were females, showing that there were more men in the business of cassava production than women in rural Oyo State. The age range of the farmer was between 21 and 60 years and the mean age of respondents is 38.9 years. This is in line with Rothma et al. (2002) who opined that the age bracket is the economically active age and as such will respond positively to any intervention aimed at improving their productive capacity. The marital status of the farmers shows that 69.1 percent are married while singles, widow(ers) and divorced comprised 22.7 percent, 2.7 percent and 5.5 percent, respectively. This is a good development because the family members of the married farmers will always join and assist in farm work. Their availability reduces labor constraints faced during the peak of the farming season (Teklewold et al. 2006), which will eventually lead to increase in cassava production in the study area.

Table 1: Socio-economic characteristics of Cassava farmers in rural Oyo State

Characteristics	*Frequency*	*Percentage*
Sex		
Female	80	72.7
Male	30	27.3
Total	110	100
Age (Year)		
21-30	24	21.82
31-40	36	32.73
41-50	38	34.55
51-60	12	10.9
Total	110	100
Marital Status		
Single	25	22.7
Married	76	69.1
Divorced	6	5.5
Widow(er)s	3	2.7
Total	110	100
Educational Level		
No formal education	16	14.5
Primary education	50	45.5
Secondary education	37	33.6
Tertiary education	7	6.4
Total	110	100

Source: Field survey 2013

The analysis also shows the average household size to be 7. Since agricultural production activities are labor intensive, large households can provide farming labor at little or no cost (Kalu 2003). Also, 85.5 percent of the farmers are educated and this is good as the respondents stand a good chance of welcoming and embracing new innovation in cassava production. The average year of experience in cassava farming was 16.15 years. This indicates that most farmers have been practicing farming for long, and the accumulated years of experience will help farmers in better planting, seasonal knowledge, pest and disease control, agronomic and technical problems in cassava farming that might occur.

Table 2 reveals that 47.3 percent of the respondents inherited their farmlands. This will invariably lead to fragmentation of farm holding, which in turn leads to operating on small scales. Also, 48.2 percent of the respondents rented the land used for cassava cultivation. The respondents' major source of capital is their personal savings, 75.5 percent of farmers recorded this and this is not far from the reason why they are small-scale farmers since they have limited capital to operate on a large scale. It was discovered that the largest percentage that is, 61.8 percent of the farmers operate on 1-3 hectares of land, which attests to what Omonona (2009) opined that Nigeria's food security depends mainly on food production of small-scale farmers cultivating not more than 2.5 hectares of land that are usually scattered over wide areas of land, using poor technologies, which makes their output very low and invariably leads to low profitability.

Labor is an important factor of production, which can be hired, family or both. It was recorded that 55.5 percent of the farmers use both

Table 2: Respondents production activities

	Acquisition frequency	*Percentage*
Mode of land		
Leased	53	48.2
Purchased	5	4.5
Inherited	52	47.3
Total	110	100
Source of Capital		
Personal Savings	83	75.5
Friend and Relation	6	5.5
Co-operative	12	10.8
Bank Loan	7	6.4
Fadama Loan	2	1.8
Total	110	100
Farm Size (Ha)		
<1	18	16.4
1.1-3.0	68	61.8
3.1-5.0	19	17.3
5.1-7.0	5	4.5
Total	110	100
Source of Labour		
Hired	22	20.0
Family	27	24.5
Both	61	55.5
Total	110	100

Source: Field survey 2013

family and hired labor, which implies that most of the farmers were involved in labor one way or the other since they are small-scale farmers with personal savings as their source of capital (Ezebuiro et al. 2008). In addition, 99.1 percent of the farmers did not use fertilizer and other chemicals, and this could be responsible for low or poor productivity of cassava recorded by some of the farmers. All the respondents use stem cutting as their mean of cassava propagation.

Gross Margin Analysis Result

Total Cost of production/hectare {TC}= ₦120,161.31k

Total Fixed Cost {TFC} =₦ 8,379.54k

Total Variable Cost {TVC} =₦ 111,782.7k

Total Revenue {TR} =₦ 174,231.81k

Therefore,

GM=TR-TVC=₦174,231.81K -₦111,782.7k= ₦62,449.11K /Ha

Also,

Net Return/Profit = GM – TFC = 62,449.11k - ₦ 8,379.54k = ₦ 54,069.57K/Ha

The profitability analysis revealed that the Gross Margin of rural farmers in Oyo state is ₦ 62,449.11K /Ha and profit of ₦54,069.57K /Ha. These simply indicate that cassava business is a profitable venture in the study area.

Regression Analysis

In Table 3, the dependent variable is Net Return/Profit of the rural famers while the statistically significant independent variables were cost of ridge making (X_2), cost of land clearing (X_3), cost of weeding (X_4), cost of feeding (X_5), cost of cassava stem (X_6), cost of transport (X_7), type of labor used (X_{13}), use of fertilizer (X_{14}),

Table 3: Regression analysis and the estimates is given thus

Variable	*Coefficient*	*Std. error*	*Prob t-statistic*	*Level of sig*
Cost of land rentage (X_1)	-9.918E-02	0 .222	-0.447	Nil
Cost of ridge making (X_2)	-0.929***	0.057	-16.388	1%
Cost of land clearing (X_3)	-1.116***	0.06	-16.927	1%
Cost of weeding(X_4)	-1.351***	0.098	-13.829	1%
Cost of feeding(X_5)	-0.461**	0.187	-2.462	5%
Cost of cassava stem (X_6)	-0.665*	0.345	-1.929	1%
Cost of transport (X_7)	-1.069***	0.142	-7.523	Nil
Bargaining cost (X_8)	-1.564	1.188	-1.316	Nil
Age (X_9)	23.838	36.877	0.646	Nil
Educational level (X_{10})	99.837	387.267	0.258	Nil
Source of finance (X_{11})	141.819	290.793	0.488	Nil
Year of experience (X_{12})	1.978	33.729	0.059	5%
Type of labourused (X_{13})	-745.663*	385.497	-1.934	1%
Use of fertilizer (X_{14})	25742.015***	4669.679	5.513	Nil
Use of chemicals (X_{15})	4895.457	3270.727	1.497	Nil
Price per truck(X_{16})	0.172**	0.071	2.421	5%
Total revenue (X_{17})	0.955***	0.011	90.252	1%
Constant	-63362.144	8554.341	-7.407	1%
R-squared	0.996	F-statistics	1225.466	
Adjusted R-squared	0.995	Prob (F-statistics)	0.000*	

Source: Field survey 2013

price per truck (X_{16}), and total revenue (X_{17}). The adjusted R^2 is 0.995 showing that 99.5 percent of the variability in the dependent variable is explained by the explanatory variables. This also shows that the model produced a good fit for the data since the computed F-value was statistically significant at ($p<0.01$).

Cost of ridge making, cost of land clearing, cost of weeding, cost of transport, use of fertilizer and total revenue were all statistically significant at $p<0.01$. Cost of feeding and price per truck were statistically significant at $p<0.05$, while cost of cassava stem and type of labor used were statistically significant ($p<0.10$). However, the rest seven exogenous variables that is, cost of land rent (X_1), bargaining cost (X_8), age (X_9), educational level (X_{10}), source of finance (X_{11}) year of experience (X_{12}), and use of chemicals (X_{15}) were not statistically significant ($p>0.10$).

The negative coefficient of cost of ridge making (-0.929) indicates an inverse relationship between cost of ridge making and profitability in that rural farmers' profitability decreases as the cost spent on ridge making increases. This is actually expected because cost of ridge making is part of cost of production and the higher the cost of production, the lower the profit of a producer vice versa. The parameter of cost of land clearing is also negative (-1.116), meaning that the more the cost expended by this small-scale farmers in the course of clearing during cultivation, the lower the profit in the long run. This also is in line with basic economic principle of production.

Also, costs of weeding have -1.351 as its coefficient, which implies an inverse relationship, which can be translated as the higher the farmers' in the study area spend on weeding, the lower the profit of such farmers. This is expected since there is a principle that says, *"When you minimize cost, you maximize profit, ceteris paribus".* In addition, the negative sign of the coefficient of cost of feeding (-0.461) implies that the higher the farmer spends on feeding during the production time, the lower the profit. This has serious theoretical back ups, as more cost on feeding might open doors to more food/ration for an individual laborer at work and when a laborer's stomach is heavy, he does little or nothing and this will invariably tell on the profit of the rural farmers.

More so, cost of cassava stem have a negative coefficient (-0.665), which means that the higher the cost of cassava stem cutting used in production, the lower the profit made by the farmer. This is expected because the study address rural small-scale farmers here, this is simply the rationale behind the tradition of these farmers collecting stem cutting from each other's because in so doing, the farmer is also minimizing cost of production. Furthermore, the parameter of cost of transportation to point of sale carries a negative coefficient (-1.069), which implies that if a farmer spends too much of his production cost on transporting the harvested cassava to point of sale, he will have lesser profits. This is a prior expectation since transportation of cassava to point of sale is also part of cost of production.

Type of labor used is also negative (-745.663) and significant with a simple interpretation that higher the cost on labor, the lower the farmers profit. This is expected and it is the reason behind the farmers' use of family labor to reduce their cost of production. On the other hand, the positive sign of the coefficient of use of fertilizer (25742.015) explains that the more the farmers use fertilizers in cassava production, the higher the profit they have. This is actually expected because fertilizer application will increase the yield of crop although it's expected to be little in cassava planting but still necessary and will in turn lead to higher profit.

Price per truck also is positive and significant (0.172), and this implies a direct relationship between price per cassava truck harvested and profit level, that is, the more the number of trucks harvested from a farmers' farmland, the higher the profit. This is real and logistic because more number of trucks harvested from a farmland brings in more return and resultantly more profit. Finally, the parameter of total revenue (0.955) had a positive coefficient, which indicates a higher profit if a farmer has total revenue. In order words, the higher the total revenue from small-scale cassava farming, the higher the profit of farmers and this is purely in line with basic economic theory.

CONCLUSION

Some of the associated problems of cassava production by rural small-scale farmers were inadequate capital, high cost of fertilizer and herbicides, high cost of transportation due to poor road, inefficient/ineffective extension delivery systems, land tenure, pest and diseases, and

agronomic problems that constitute major production constraints for the sampled rural farmers. The consolation from this research however is that the cassava business has prospects because the profitability analysis returns a Total Revenue {TR} of ₦174,231.81k and profit of ₦ 54,069.57k/Ha. This submission is also supported by the data from regression analysis, which indicates among others that at one percent level of significance, total revenue had positive and significant influences on profit. It is however, believed that with time and workable agricultural food policy, these small-scale farmers will improve on their performance and production scale thereby having better profit and growth to become major producers of cassava in the state, nation and world at large.

RECOMMENDATIONS

Based on the findings, it is strongly recommended that there should be urgent mass education of rural farmers on high yielding varieties through effective extension service on cassava production. More so, pest and disease problems are still handled with levity by rural farmers forgetting that though cassava is a hardy, pest and disease infestation reduces its yield. For increase in productivity, policies that ensure that these farmers have access to land should also be implemented to stop the problem of land fragmentation often faced by the enthusiastic rural farmers. Also, infrastructural facilities cannot be overlooked in the study area, good roads, which will link farms to main villages and towns around should be constructed in order to reduce the alarming cost of transportation of produce to point of sale.

Finally, since it is known by the entire international community that Nigeria is currently the largest producer of cassava in the world, which simply suggests that the country has a comparative advantage in its production, the government of the day should persistently mobilize resources, formulate and implement workable agricultural food policies and programs that will promote cassava production most especially in the area of finance in order to encourage farmers to operate on a larger scale as being emphasized by good number of rural small-scale farmers in the study area, having established the fact that cassava production is a lucrative venture that is worth national investment.

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