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Full Length Research Paper

Socio-economic determinants and profitability of cassava production in Nigeria

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Nigeria remained an importer of cassava products that can be derived from cassava in spite of her leading position in cassava production. Instability in production of the crop hindered its diversification to manufacturing industry. Therefore, the paper investigated socio-economic factors that determined productivity and profitability of the crop in Nigeria. Regression and budgetary techniques were used in analyzing primary data collected through a survey of farmers. Results revealed three significant determinants of net profit were land area planted to cassava, man-days of labour used and marketing cost incurred by the farmer. Effects of land area planted were positive, while those of man-days of labour and marketing cost were negative on net profit. Also, three significant determinants of cassava output were land area planted, marketing cost and age of the farmer. 10 per cent increase in area planted resulted into 4.8 percent increase in output. 10 percent increase in marketing cost brought about 5.5 percent decline in output, while 10 per cent increase in age of the farmer led to 3.8 per cent decline in output. Majority of the farmers sold their products on the farm due to high transportation cost and bad road. Policy efforts should include increasing use of yield-enhancing practices and improving rural infrastructure and marketing.

Keywords: Cassava, yield, profitability, technology, and market.

INTRODUCTION

In Sub-Saharan Africa, cassava is important, not just as a food crop but as a major source of cash income for a large population, particularly farmers who cultivate the crop on farms that are often regarded as fallow. The crop also grows very well on marginal soils, replacing crops that require greater soil fertility (NISER 2013, Hillocks, 2002). Total world cassava demand would reach 275 million tonnes by 2020 (Westby, 2008) while Africa now produces about 62 per cent of the total world production with Nigeria being the largest producer of the crop in the world with output level of 54 million tonnes in 2013 (FAOSTAT, 2015). Nonetheless, less than 5 per cent of the output produced in Nigeria is used in the industries while about 95 per cent is used for human consumption (NISER, 2013). Industrial users of cassava products in the country consisted mainly of bakeries, flour mills, livestock and pharmaceutical firms.

In spite of the leading position of Nigeria in the production of the crop, the country still imports significant quantities of cassava products such as starch, flour, sweeteners that can be derived from cassava (Table 1.1). In the country, agriculture has not really played the role of supplying adequate raw materials to the industrial sector. Over the years, enormous foreign exchange resources have been utilized for the importation of various raw materials for the manufacturing sector (Sanusi, L.S, 2012).

This constituted a drain on the foreign exchange resources of the country. What is more worrisome is that a good proportion of these raw materials can be sourced from agricultural produce locally. For instance, over 2005-2011, raw material imports averaged 20.4 per cent of the total imports (Sanusi, L.S, 2012). In 2005, it was $8.8 billion and accounted for 30 per cent of the total, but

Table 1.1. Production, Consumption, Exportand Import of Cassava Productsin Nigeria.

Year	Domestic Production of Cassava in tonnes	Domestic Consumption of cassava products in metric tonnes.	Importation of cassava products in tonnes	Import Value of cassava products in US Dollar.	Export Quantity cassava products tonnes	Export Value of cassava products in US Dollar.
2002	34,120,000	35,609,000	Na	Na	11,500	200,000
2003	36,304,000	36,294,000	225	85,000	10,975	140,000
2004	38,845,000	38,844,000	225	85,000	375	37,000
2005	41,565,000	41,558,000	25	3,000	6,235	179,000
2006	45,721,000	45,717,000	25	3,000	3,970	186,000
2007	43,410,000	43,402,000	335	74,000	8,365	337,000
2008	44,582,000	44,570,000	1,035	79,000	12,755	600,000
2009	36,822,000	36,822,000	1,035	79,000	1,240	191,000
2010	42,533,000	42,532,000	2,495	331,000	1,925	278,000
2011	52,403,000	52,402,000	13,290	1,677,000	12,895	637,000

Source: FAOSTAT, 2015

fell to $8.3 billion and $8.2 billion or 18.9 and 12.5 per cent in 2008 and 2011, respectively. As a proportion of the total raw materials imported, industrial agricultural raw materials accounted for 23.7 per cent ($2.1 billion) in 2005, 26.6 per cent ($2.2 billion) in 2008 and rose sharply to 69.8 per cent ($5.7 billion) in 2011.

Consumption of cassava in Nigeria varied from 35.6 million tonnes in 2002 to 52.4 million tonnes in 2011 while export of cassava products remained very low ranging from 375 tonnes in 2004 to 12,895 tonnes in 2011. An overwhelming proportion of cassava produced in Nigeria goes to human consumption while a very low proportion goes to industry and foreign trade. Thus, foreign exchange generating capacity of the crop still remained largely unexploited. Current reality is that, the Nigerian economy is indeed mono-cultural with dominance of oil to the detriment of other more tradable and productive sectors such as agriculture and manufacturing, which were largely degraded when oil boom lasted (Faborode, 2016). The impact on development has been low welfare capacity, low employment, high inequality and hence high multidimensional poverty or the paradox of poverty in the midst of plenty. Despite considerable oil resources as reflected by Table 1.2, Nigeria still has its citizens wallowing in abject mass poverty even in the midst of abundant agricultural resources. It is estimated that while about 70 per cent of Nigerians live below the poverty threshold in 1999 (69 per cent actually lived on less than $1 per day), the figure was 60.9 per cent by 2014 (NBS, 2014). Lack of diversification has been made worse by the mineral and oil sector which has been generally dominated by large-scale operations and transnational corporations that do not have substantial linkages with other sectors of the economy.

More confounding is the instability in cassava production trend as indicated by Table 1.3 and the corresponding Figure 1.3. The instability has hindered diversification of cassava as raw materials to cassava-based processing and manufacturing industry in the country resulting into segmented markets of sub-optimal size which does not ensure profitability of sizeable private investment in the different stages of the cassava value chain and thus resulted into underdeveloped value chain.

Underdevelopment of cassava value chain aggravates supply-demand gaps in the cassava subsector and the gaps are increasingly being filled by imports, thus dampening the prospects for cassava transformation, revenue generation and poverty reduction among the smallholders in the country.

Many initiatives such as presidential initiative and transformation agenda have been implemented on cassava by the government of Nigeria over the past few years with little or no impact on industrial utilization, competitiveness and export. Export share of the country in the cassava global market has remained very low even after the implementation of the initiatives. Production cost in processing factories remained exorbitant. High production cost has been aggravated by high transportation arising from poor condition of road to the farms of smallholder farmers and high cost of alternative source of energy (generating plant) arising from epileptic power supply in the country. Poor road and transportation facilities has hindered linkage of smallholders to emerging market despite Nigeria being the largest producer of cassava with expanding area under cultivation of the crop. More worrisome is the abysmally low yield of the crop in Nigeria. In terms of yield per hectare, Nigeria ranked eighth among the ten top cassava producing countries while Cambodia ranked first and Thailand ranked second as indicated by Table 1.4.

Table 1.2. Nigeria, Top 10 Export Commodities 2008 to 2010.

HS Code	4-digit Heading of Harmonized System, 2002	Value (million US$)		
		2008	2009	2010
	All Commodities	81,820.5	49,937.5	86,567.9
2709	Petroleum oils, crude	74,832.1	42,212	60,904.6
2710	Petroleum oils, other than crude	7.9	15	9,805
2711	Petroleum gases and other gaseous Hydrocarbons	224.6	2,895.5	4,716.8
4113	Leather further prepared after tanning or crusting	468.3	315.1	2073.8
1801	Cocoa beans, whole or broken, raw or roasted	510.3	1,250.9	1,048
8905	Light vessel, fire-floats, dredgers, floating Cranes and other vessels	1,561.6	9.5	314.6
4106	Tanned or crust hides and skins of other animals, without wool or hair	209.4	195	956.4
4001	Natural rubber, balata, gutter-percha, Guayule, chicle	420.9	170.4	555.3
1207	Other oil seeds and oleaginous fruits	153.5	194.7	641.5
3901	Polymers of ethylene, in primary forms	516	82.9	138.6

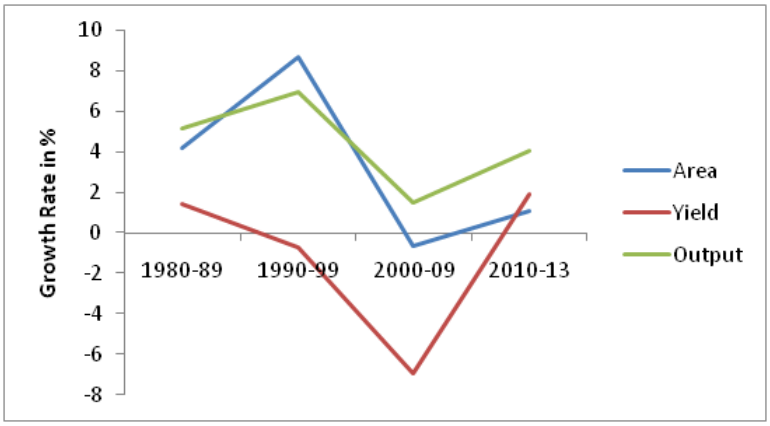
Source: NBS: Annual Abstract of Statistics

Table1.3. Trend of Cassava Production in Nigeria, 1980-2013.

Year	Area Planted in Thousand Hectares		Yield in Kg per Hectare		Output in Thousand Tonnes	
	Actual	Growth	Actual	Growth	Actual	Growth
1980-89	1245.40	4.20	10193.80	1.43	12714.70	5.18
1990-99	2774.70	8.69	10718.70	-0.70	29570.80	6.97
2000-09	3548.10	-0.64	10836.60	-6.94	38544.70	1.51
2010-13	3684.11	1.09	12288.86	1.92	45358.07	4.05
Average	2813.08	3.34	11009.49	-1.07	31547.07	4.43

Source: Underlying data obtained from FAOSTAT, 2015.

Figure 1.3. Growth Rate of Area, Yield and Output of Cassava.



Studies have shown that economic development requires structural change from low to high productivity activities and that the industrial sector should be well linked to agriculture in the development process. The work of

Table1.4. Yield of Cassava in Ten Top Producing Countries of the World in Tonnes per Hectare.

Countries	2008	2009	2010	2011	2012	2013	Average	Ranking
Angola	14.81	15.18	15.58	13.36	10.01	14.05	13.83	7th
Brazil	14.14	13.86	13.95	14.62	13.61	13.91	14.02	6th
Cambodia	20.43	21.81	21.00	21.74	22.59	22.86	21.74	1st
Congo	9.97	9.85	8.89	7.61	7.84	7.81	8.66	9th
Ghana	13.51	13.81	15.43	16.01	16.75	16.72	15.37	5th
Indonesia	18.10	18.75	20.22	20.30	21.40	22.46	20.21	3rd
Mozambique	4.25	4.52	7.76	7.80	13.18	12.82	8.39	10th
Nigeria	11.80	11.77	12.22	14.02	14.03	14.03	12.98	8th
Thailand	21.25	22.68	18.83	19.30	21.91	21.82	20.97	2nd
Viet Nam	16.80	16.80	17.26	17.73	17.69	17.90	17.36	4th

Source: FAOSTAT, 2015.

Oyelaran-Oyeyinka (2012) as cited by Faborode (2016) indicates a close synergy, especially with respect to value-addition, between agriculture and manufacturing. High and sustained economic growth rates, alongside improved levels of social development can be achieved if productivity growth derives from widespread economic diversification of the economy into manufacturing and high technology services, if it fosters inclusive entrepreneurship to instigate employment, and if it promotes industrial manufacturing and innovation. Indeed manufacturing can provide demand for primary products, as industrial manufacturing feedstock, and stimulate growth in those sectors.

Industrial and commercial application of cassava has huge potential in Nigeria. High quality cassava flour (HQCF) can be an affordable substitute for wheat flour with high potential to use 20 per cent cassava flour into wheat flour that can save the country 163 billion naira annually and create about 3 million jobs. Transformed cassava products including chips, flakes, cubes, and pellets are in high demand in the global markets. Many European and American countries including Germany, UK, France and Netherlands demand huge quantities of processed cassava products annually. The high demand for transformed products of cassava in foreign market can be a significant source of income diversification for about two-third of the entire country, covering about twenty-four states with southern part of the country producing the largest proportion in terms of area covered and number of farmers growing the crop.

Nonetheless, smallholder producers and processors of cassava in Nigeria are increasingly being confronted with difficulty in accessing markets and creating interest in new market opportunities. Exploiting the new opportunities has been hindered in Nigeria due to low processing technology as well as poor linkage of farmers to cassava-based manufacturing industry. Admittedly, most of Nigeria cassava farmers, businessmen, private investors and industrialists have not fully exploited the investment potentials in cassava. In the real sense, the level of industrial utilization of cassava is low when compared to its potential to generate increased foreign exchange earnings which is expected to reach $8.5 billion in value by 2020 as enunciated in the Agricultural Transformation Agenda of Nigerian Government (FMARD,2013: Agricultural Transformation Agenda Score Card).

Cassava production is now facing the challenge of how to meet the industrial demand towards establishing up to 40 per cent high quality cassava flour (HQCF) in wheat bread and 10 per cent ethanol in gasoline with 50 per cent of that from cassava. It has become imperative to expand supply of cassava for industrial utilization because of the need to attract indigenous and global firms and investors that have indicated interest in making investment in cassava starch and other related products. More importantly, the current global crash in price of crude oil has resulted into dwindled revenue for Nigerian government leading to general economic downturn. The current economic downturn has made it necessary to reposition Nigerian agriculture to generate increased foreign exchange and income to farmers. As an important industrial crop, expanded production and utilization of cassava can be used as a springboard to wriggle out of the economic downturn in Nigeria.

The above development have brought to the fore the need to provide answers to the following questions. What are the factors that significantly determine productivity and profitability of cassava in Nigeria? What is the level of profit realized by cassava farmers in Nigeria? What are the constraints limiting small holder's productivity and access to market and how can the productivity and access to market be improved? Providing answers to these questions constitute the major challenge of this paper. The recent global fall in the price of oil is a compelling reason for exploiting the potentials of cassava for generation of revenue and foreign exchange earnings.

Accessing new markets with cassava products and rising demand for cassava products by the emerging cassava-based industry has created incentives to expand production of cassava in the country. Thus the focus of the paper on cassava was based on its strategic importance in industrial application, food security as well as increased export of high valued products of cassava for generating increased foreign exchange earnings. The remaining sections of the paper are structured as follows. Following this introductory section is section two which presented theoretical issues and review of literature. Section three discusses research methodology. Section four concentrates on discussion of empirical results while the paper is rounded off in section five with policy implications and conclusion.

Theoretical Underpinning and Review of Literature

There is a general consensus in the literature that low productivity is one issue militating against processing, marketing and investment in agricultural raw materials in Nigeria (UNECA, 2009, Sanusi, L.S, 2012). Low productivity has been attributed to the nature of agricultural production. Most Nigerian farmers are smallholders who do not adopt yield-enhancing practices and techniques like the use of agro-chemicals, mechanization, and irrigation. Evidence has shown that the economic rate of return of agricultural research on output ranges from 117 per cent for sorghum to 80 per cent for rice, 30 per cent for cassava, 51 per cent for wheat and 29 per cent for livestock (UNECA, 2009). It has been observed that under-capitalization of agriculture has given rise to a weak knowledge-based sector, leading to low input and low value added. It is estimated that agricultural land productivity in Africa, including Nigeria is 42 and 50 per cent of those of Asia and Latin America, respectively (UNECA, 2009). Not only is land productivity low, labour productivity in Africa is lowest in the World, amounting to only 57 per cent of those of Latin America and 58 per cent of those of Asia (UNECA, 2009, Sanusi, L.S, 2012). Increasing agricultural productivity is an important policy goal of the Nigerian government since agriculture is the source of food and livelihood for the population that are most vulnerable to poverty.

Conceptually, increasing agricultural productivity can take place through any of the following alternatives. Firstly, by increasing output and input with output increasing proportionately more than inputs. Secondly, it can take place through an increase in output while inputs remain constant. Thirdly, it can be through a decrease in both output and input with input decreasing more. Fourthly, productivity increase can take place through a decrease in input while output remains constant (Adewuyi, 2006). Increasing inputs in order to expand output requires raising both the quality and quantity of inputs, examples of which is utilization of mechanization to support production and processing of cassava. This involves the use of high yielding variety, use of fertilizer, application of irrigation in areas where rainfall is inadequate, and use of agrochemicals such as herbicides and pesticides. In Africa including Nigeria, the aforementioned process has the potential for productivity enhancement but smallholder farmers cannot afford the investments due to their limited resources and limited access to credit. The smallholder farmers make up at least 73 per cent of all rural Africans and they produce about 90 per cent of food consumed in Africa (Odulaja and Kiros, 1996). It has been established that where cassava farmers have access to markets they tend to adopt productivity enhancing technologies to expand production.

Furthermore, according to Olayide and Heady (1982), important factors that will influence production include price of the commodity, prices of all other commodities, the price of factors of production and the state of technology. The authors therefore defined agricultural productivity as the ratio of the value of total farm outputs to the value of total inputs used in farm production. Thus agricultural productivity is measured as the ratio of final output in appropriate unit of measurement to some measure of inputs. In this study, the concern is the input of many variable resources such as seed, fertilizer, manure, insecticide, herbicides and the output of cassava. The production function for this relationship in the implicit form is expressed as:

$$Q = f(X_{1,} X_{2,} X_{3.....,} Xn) \quad (2.1)$$

Where Q is the output of cassava, Xi is the varied input of resources.

Apart from the technical characteristics of the production process and changes in relative input-output prices, socio-economic characteristics of the farming households, as well as farms' characteristics have been found in the literature to significantly influence the average level of efficiency and productivity of farmers. Studies such as Yao and Liu (1998), NISER (2001), Ugwumba and Omojola, 2012, and Oni, (2013) have shown that profitability and average level of output of farmers are significantly affected by the socio-economic characteristics of the household. Such characteristics included age of the farmers, experience in farming, gender, marital status, household size, and level of education of the farmer. General and specific characteristics of farms and their operators affect overall levels of production and productivity, generating different levels of returns to farming activities. Such characteristics as farm size, use of conservation practices, irrigation and water availability, land tenure, as well as market conduct have all shown some influences over enterprise and technology choice, input use and market participation. Personal factors that affect an individual's management skills or entrepreneurial ability have been identified in the

literature. These included attributes such as the level of education, farming experience, age, or any vocational training. They reflect a farmer's ability to understand farm technologies and their impact on farming as farmers do vary in their management skills. Age and education level of farmer are considered significant in adoption of improved farm technology (Akkaya Aslan S.T., Gundogdu K. S., Yaslioglu E, Kirmikil M and Arici, I 2007).

Moreover, physical features of a farm including size, infrastructure such as irrigation, drainage, and road system, topography, soil type, and number of parcels have been identified as important factors that exert influence on productivity and profitability of agriculture in Africa. Farm size is one of the most important determinants in the adoption of new developments (Akkaya Aslan S.T., Gundogdu K. S., Yaslioglu E, Kirmikil M, and Arici, I 2007). Its relationship with adoption depends on fixed costs of new technology, risk preferences, and constraints on credit availability. In adopting new technology, farm size, number of parcels, parcel size, and parcel shape are all important. Irrigation, drainage, road systems, and land arrangement are also important factors for enhancing productivity and farmer's satisfaction. Dispersed and poorly-shaped lands will start to accrue benefits of improved technology when land consolidation and infrastructure problems are solved.

It has been established in the literature that physical characteristic of farm such as farm fragmentation exists in many parts of the world and typically occurs in Nigeria where landholdings of individual farmers are small and widely dispersed. However, opinions concerning the drawbacks and merits of fragmented land ownership differed. Some authors pointed out that there are significant benefits for the individual farmer, such as ecological diversity (Bentley, 1987; Agrawal, 1999; Tan S, Heerink N, Qu F (2006). That is, by planting crops in several different ecological zones, a farmer reduces the risk of a scanty harvest. Others contended that farm fragmentation is the single greatest deterrent to modern agricultural development, creating inefficiencies in the movement of labour and machinery, hindering large-scale mechanization of production processes (Akkaya Aslan S.T., GundogduK. S., Yaslioglu E, Kirmikil, M. and AriciI, 2007).

In sub-Saharan Africa, limited farm size is seen as one of the major factors hampering the transition from household-based subsistence farm economies to commercially-oriented production systems. Conservation practices, irrigation, and water availability have an important bearing on both long-term farm income and resource sustainability. Secured land tenure provides operators with a strong basis for investment, as land can often be used as collateral for loans. Even though Nigeria is blessed with vast agricultural land, the communal ownership structure and the patriarchal nature of inheritance in Nigeria make it difficult for certain segments of the population to own and control land (NISER, 2002). Indeed, household characteristics and household composition in terms of age and gender will help to address the window of opportunity for household, availability of labour force as well as ratio of dependency. These aspects are crucial when analyzing household productivity as well as physical and economic access to production resources and participation in the market. Thus the socio-economic variables should be incorporated into the production function in equation 2.1 above. For instance, education is an important determining factor for understanding and adoption of innovation which directly affects ability to increase productivity and profitability of agricultural enterprise.

On the basis of the foregoing, the theoretical underpinning of the study hinges on the theory of agricultural production. A production function is the technical relationship between inputs and outputs, that is, a function that summarizes the process of conversion of factors into a particular output. It shows the maximum amount of the output that can be produced using alternative combinations of the various inputs. The concept of profitability draws on the difference between the investment cost and returns. Profitability refers to the size of profit made relative to the size of the business or the resources used to produce the profit (Odii, 1998). In the analysis of farm income, budgetary technique is mostly employed to measure profitability of farm business. Profitability measures the ability of farmers to recover their costs. It is an important concept, because it provides incentives for entry into the farming business.

In general, there is a consensus in the literature that Nigerian farmers can be described as rational profit maximizers who respond to price signals. Many previous studies on Nigerian farms across the country report that profit margins are often very small Agwu, N.M, C.I. Anyanwu, E.I. Mendie (2013), Ndubueze, Ekine, (2014), Ogisi O.D., Begho T, Alimeke BO (2013). Furthermore, Kingsley Okoi Itam, Eucharia Agom Ajah and Emmanuel Edet Agbachom (2014) carried out analysis of determinants of cassava production and profitability in Cross River State of Nigeria. They found that cassava production was profitable. The results further revealed that farm size, value of land, gender, age, educational level and farming experience influenced output positively, while value of cassava cuttings, labour and family size had negative influence on cassava output. However, the test of significance showed that cassava cuttings, labour, education and experience exerted greater influence on cassava output, implying that a change in any one of these variables resulted into a significant change in output. One of the most serious problems encountered by cassava farmers in the study area was high cost of inputs, while lack of implements constituted the least problem. The study recommended implementation of policies that will enhance farmers output.

In addition, some authors have recommended that improved cassava cuttings and inputs such as fertilizer should be provided for farmers at subsidized rate, while some recommended that farmers should be encouraged to pool resources together in order to purchase necessary farm inputs and cassava processing industries should be established in the area to manage the massive supply of cassava tubers during the period of glut. The previous authors have placed much emphasis on a particular location in the country without considering the entire country. Similarly the marketing constraints confronting the farmers at the farm gate level were not adequately explored. Thus, this paper made an effort to fill up this gap.

METHODOLOGY

Analytical Framework and Model Specification

Socioeconomic characteristics of cassava farming households are important factors that would influence output level and returns to farming households. Thus the average area planted to cassava is expected to have positive correlation with quantity of cassava harvested. Mandays of labour used, fertilizer used, type and the number of tools and equipment employed in production will provide explanation for the type of technology adopted which will exert influence on output. High cost of each input is expected to negatively affect profit level realized by the farmer.

Resources that are considered in the estimation of the model specified for cassava production included seed, fertilizer, labour, credit and manure. It was hypothesized that each of the inputs would exert positive effect on productivity and profitability level. Fertilizer application is important to cassava production particularly in the northern part of the country where the soil is low in fertility. Thus, well-managed fertilizer use in this part of the country will boost the soil fertility in fragile and nutrient-poor soil which would in turn induce increased cassava production. Availability of credit is crucial to improving production and overall performance of farmer. It is hypothesized that the larger the household size the more available hands for farm-work which would provide higher man-days of labour for cassava production. This would in turn lead to higher output and profit level. Since education is a factor of knowledge transfer and adoption of technology, the higher the level of education or years of schooling by a farmer, the higher will be his output and profit realized. Similarly, age composition of a typical farm household, to a large extent, will determine the number of hands that may be available for farm work at a given time. Therefore, the empirical model for analyzing the socioeconomic determinants and profitability of cassava production in Nigeria is expressed as follows.

Model for Net Production Income:

NPI = f (AGE, GEN, HHS, MAS, FAS, EDL, FAE, COP, e) …… (3.1)

$NPI = \beta_o + \beta_1 AGE + \beta_2 GEN + \beta_3 HHS + \beta_4 MAS + \beta_5 FAS + \beta_6 EDL + \beta_7 FAE + \beta_8 COP + e_1$ …… (3.2)

Model for Output:

QCAS =f (QCAC, PCAC, QF, FP, QMan, PMan, MDL, FAS, AGE, HHS, EDL, FAE, COP, e)……3.3).

$QCAS = \alpha_0 + \alpha_1 QCAC + \alpha_2 PCAC + \alpha_3 QF + \alpha_4 PF + \alpha_5 QMan + \alpha_6 PMan + \alpha_7 MDL + \alpha_8 FAS + \alpha_9 AGE + \alpha_{10} HHS + \alpha_{11} EDL + \alpha_{12} FAE + \alpha_{13} COP + e_2$ …… (3.4)

Where

NPI = Net Production Income in Naira (₦) = Net Profit.
AGE = Age in years.
GEN = Gender (dummy: male = 1; female = 2)
HHS = Household Size (number of people living together)
MAS = Marital Status (dummy: married = 1; single =2)
FAS= Farm Size in hectare
EDL = Educational level in years of schooling
FAE = Farming Experience in years
COP = Cost of Production in Naira (₦)
QCAS= Output of Cassava in Kg.
QCAC = Quantity of Cassava cuttings in Kg
PCAC = Price of Cassava Cuttings in naira per Kg
QF = Quantity of fertilizer in Kg
PF = Price of Fertilizer in Naira per Kg.
QMan = Quantity of Manure in Kg
PMan = Price of manure in Naira per Kg.
MDL = Mandays of Labour.
$\beta_0, \beta_1, \beta_2 \ldots\ldots \beta_8$ = parameters to be determined in equation (3.2).
$\alpha_0, \alpha_1, \alpha_2 \ldots\ldots \alpha_{13}$ = parameters to be determined in equation (3.4).
e_1, e_2= stochastic error terms.

Profitability of the enterprise is mathematically expressed as:

GM = TR-TVC……(3.5)
NPI = GM - TFC = TR-TC……(3.6)
GRR= $\frac{GM}{TVC}$……(3.7)
NRR = $\frac{NPI}{TC}$ …… (.3.8)

Where

GM = Gross Margin.
TR = Total revenue
TVC = Total Variable Cost.
TFC = Total Fixed Cost
TC = Total Cost
NPI = Net Production Income= Net Profit

GRR= Gross Rate of return on Investment.
NRR = Net Rate of Return on Investment.

Nature and Sources of Data

Largely the study was based on primary data which were supported with secondary data. The study adopted multi-stage stratified random sampling procedure. The first stage was the selection of the six geopolitical zones. The second stage was a random selection of one state from each of the geopolitical zone. From each state, a random selection of one senatorial district out of three senatorial districts in each state was done from which one local government was drawn and one community was again selected from each local government area on the basis of the community with the greatest comparative advantage in the production of cassava. A random selection of ten cassava farmers was made from the list of farmers obtained in the community. The list of farmers was obtained from the officials at the office of respective state's Agricultural Development Programme (ADP). Thus a total of sixty representative farmers were drawn across the selected states in the six geopolitical zones of Nigeria. The profitability indicators computed does not necessarily depend on how numerous the respondents are. Nonetheless, the nature of the analysis is such that the validity of the results depends more on the accuracy of the data especially the input, output and price data than on large number of respondents. Structured questionnaires were used to collect primary data from the selected samples. While the paper is limited to the data at the farm gate level, analysis of data from the remaining actors in the cassava value chain is the focus of subsequent paper. Data were collected on the respondents' socio-economic variables such as age, gender, farm size, farming experience, educational level, marital status and household size. Also, data were collected on output and input variables including farm size, costs of equipment for production, fixed assets, revenues, labour (family and hired), input and output prices, wage rate as well as constraints to production and marketing by the farmers. Secondary data were obtained from internet sources and government publications.

Method of Analysis

The initial step in the estimation procedure of the specified model is the estimation of correlation coefficient to determine non-existence of autocorrelation among the variables. Descriptive statistical tools involving means, frequency distribution and percentages were used to analyze data generated on socio-economic status and constraints to cassava production and marketing. Ordinary least Squares (OLS) technique was used to estimate the specified model while budgetary technique was used to analyzed costs and profitability of cassava production.

Cost of production was disaggregated into fixed and variable costs during a production period. Variable costs are those associated with inputs such as fertilizer, manure, insecticides, herbicides and hired labour including marketing cost as well as cost of water charges for irrigation. Other variable costs included costs of transportation and planting materials. Expenditure on fixed inputs such as land rent for farming, depreciation of tools and interest rate paid on credits were included as fixed cost components. Gross margin was estimated and this is indicative of farmers' productive capacity while the net profit gives an indication of the actual returns profile after deducting the fixed cost components from the gross revenue. Gross margin and net profits were estimated to assess the level of profitability of cassava enterprise. They indicate the incentives to produce by the entrepreneur. The gross margin that accrued to each farming household in the cropping season was estimated by subtracting the total variable cost from the gross value of output.

Regarding regression analysis, the primary data were fitted with three functional forms of the specified model, namely, linear, semi-log and double-log. Among the three functional forms, the one which produced the best output in terms of sizes, signs, and number of significant parameters estimates, as well as overall significance of the estimated model was selected as lead equation.

EMPIRICAL RESULTS AND DISCUSSION

Socioeconomic Characteristics of Respondents

Gender of Respondents. The sex structure of the respondents as shown by Table 4.1.1 revealed that the cassava farmers were dominated by males, accounting for 87 percent while female accounted for 13 percent. This may be due to the fact that men are more involved in production at the farm level while women have the tendency to participate more in processing of cassava.

Age of Respondents

As shown by Table 4.1.1, age distribution is classified into four major age groups. These are, the youthful dynamic age group, which is made up of those within ages 20 years to 30 years, the actively productive working class which consist of those within ages 31 years to 45 years, the declining productivity age class which is made up of those within ages 46 years to 60 years and the old age class which is made up of those above 60 years. Given this classification, the percentage of those who fell within the youthful dynamic age categories accounted for about 6 per cent. Those within the active

Table 4.1.1 Socioeconomic Characteristics of Respondents.

Characteristics	Percentage of Respondents
Gender	
Male	87
Female	13
Age in Years	
20-30	5.5
31-45	32.7
46-60	49.1
61-70	12.7
Total	100
Average Age	50(Years)
Average Household Size	7.4(Number)
Marital Status	
Single	3.6
Married	87.3
Divorced	5.5
Widowed	3.8
Total	100
Education Attainment	
No formal Education	5.2
Primary Education	37.9
Quranic Education	8.6
Secondary Education	19.0
Tertiary Education	29.3
Total	100

Source: Field Survey, 2015.

working class were 33 per cent, while those in the declining productivity category were 49 per cent. The old people accounted for about 13 per cent. Thus the dependent population which comprised of those categorized as old people constituted about 13 per cent of the entire farm households. The age distribution pattern described above has implications for rural labour supply and cassava production. The available active household labour force constitutes those in the age categories of youthful dynamic and actively productive working class. These categories constitute only 38 percent of the entire respondents indicating that the age distribution is skewed towards aging population. The Average age of the entire respondents was 50 years. The aging cassava farmer would not easily adopt productivity enhancing technology and modern farming practices which are needed for transformation in cassava production.

Marital Status of Respondents

Table 4.1.1 reveals that majority of the respondents are married. This constituted 87 percent of the respondents. The preponderance of the married people could create potential for increased farm labour supply which would contribute positively to cassava production.

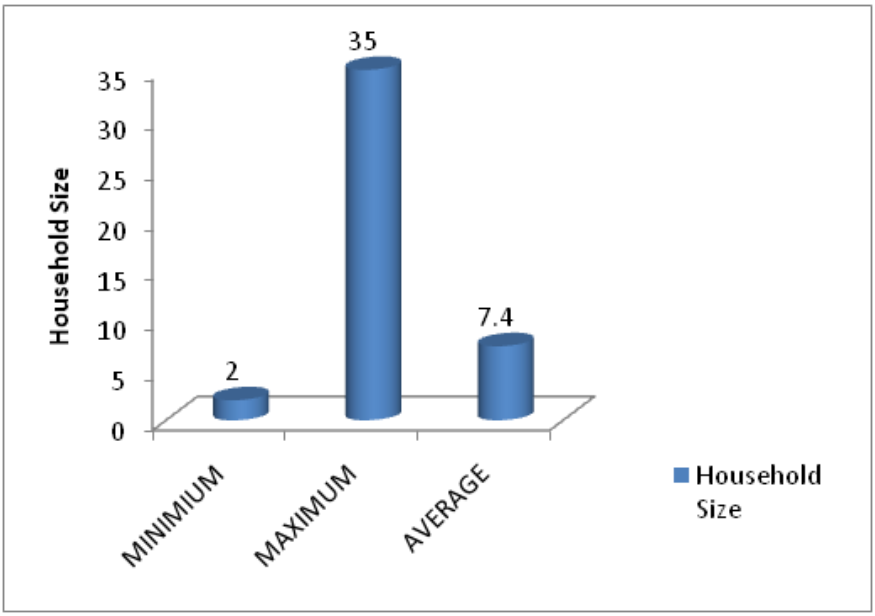
Household Size of Respondents

Due to the labour intensiveness and subsistence nature of Nigerian agriculture, the significance of the size of Nigerian farm household cannot be overemphasized. As a result of low level of mechanization, a typical Nigerian farm household relies primarily on human effort provided by the household member. Since the highest proportion of labour engaged in farming comes from the family sources, it is expected that, a farming household with higher household size is likely to have more helping hands on the family farm. As shown by figure 4.1.4, the household size ranged from a minimum of two persons to a maximum of 35 persons with average of seven persons per household. This finding is in conformity with that of NISER, 2001.

Educational Attainment of Respondents

Economic activities can be restrained or improved by the overall level of education of individual member of the house-

Figure 4.1.4 Minimum, maximum and average household size.



hold. The aspects of educational attainment of respondents which were considered in this study included average years of education within the household, number of household members who cannot read and write or barely do so. As shown in Table 4.1.1, the minimum number of years of schooling by the educated farmers was one year while the maximum was 17 years with average of 8 years of schooling. The results also revealed that majority of the farmers which constituted about 86 per cent have one form of formal education or another. Thus, it is obvious that farmers with education would likely be more adventurous in terms of technology innovation and adoption than their uneducated counterparts.

Farm and Operational Characteristics

Area Planted to Cassava

Figure 4.2.1 showed that area planted to cassava by an average farmer ranged from a minimum of 0.18ha to maximum of 4ha with average of 1.4ha. This is consistent with the fact that Nigerian agriculture is still characterized by small farm size and fragmentation of holdings.

Even though Nigeria is blessed with vast agricultural land, the communal ownership structure and the patriarchal nature of inheritance in Nigeria makes it difficult for land consolidation for adoption of yield enhancing practice such as mechanization.

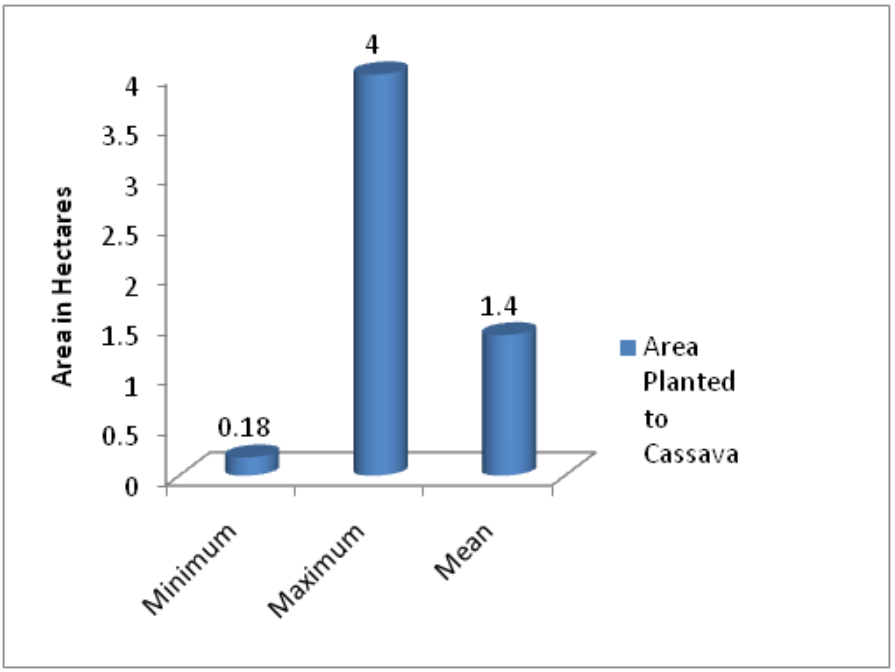
Sources of Land for Cassava Farming

Table 4.2.2 summarized sources of land for planting cassava. The table revealed that majority of the farmers acquired their land through inheritance with 62 percent. Following this were those who obtained land through rent for cassava production. This constituted about 28 per cent of the farmers. The next category was those who obtained land by outright purchase who represented about 9 per cent. The remaining group was those who obtained land though gift, which represented about 2 per cent. This results is consistent with theoretical expectation that land is acquired mostly through inheritance in Nigeria. The communal ownership structure and the patriarchal nature of inheritance in Nigeria make it difficult for farmers to own and control land. Thus the proportion of cassava farmers that acquired land through purchase remained very low. This could negatively affect the level of cassava production which ultimately may create potential for low income at the farm level.

Use of Tools and Equipments

Agricultural output is a function of inputs, of which tools and equipment are a major component. The type, number, initial acquisition cost, current cost as well as

Figure 4.2.1 Area Planted to Cassava



Source: Field Survey, 2015.

Table 4.2.2. Process of Land Acquisition.

Sources of land Acquisition	Percentage of Respondents
Rent	28.1
Purchase	8.8
Gift	1.8
Inheritance	61.4
Total	100

Source: Field Survey, 2015.

estimated life spans of the major tools and equipments utilized by the farmers are presented in Table 4.2.3. The Table revealed that hoe, water pump, knife, and cutlass, were the major tools used in cassava production. The table also revealed a moderate increase in the current market prices of tools compared with their initial cost of acquisition. When the initial acquisition cost of tools was compared with the current market price, it was observed that the market price of cutlass recorded the highest increase of 36 per cent from initial cost of ₦1100 to ₦1500 currently. The cost price of each water pump increased by 33 per cent. The prices of each hoe increased by 24 per cent while the price of each knife had increased by 11 per cent. Indications are that inflation has significantly affected the cost of most of these tools.

A common feature of the various tools and equipments utilized in cassava production is that they are crude and hand powered which are incapable of large scale commercial production. This is mainly because most of the agricultural practices are done manually in Nigeria.

Use of Non-Labour Inputs

At the aggregate level, Table 4.2.4 showed that about 53 per cent of the entire farmers applied NPK fertilizer; another 5 per cent applied Urea while 41 per cent do not apply any type of fertilizer on their farms during cropping season. There are two major types of fertilizer applied by the farmers producing cassava. These are NPK and Urea. What can be deduced from Table 4.2.4 is that NPK was the most widely used fertilizer among those using the input. On the average, about 205kg of fertilizer was applied by a farmer with average cost of 458 Naira per kilogramme.

Table 4.2.3 Type and Number of Tools and Equipment Owned by Farmers.

Name of Tools	Average number Owned Per Farming Household	Initial Acquisition Cost(Mean) in Naira	Current Market Price(Mean) in Naira	Expected Life Span of Tool (Mean) in years	Percentage of Respondents
Water Pump	1	15,000	20,000	5.0	2.6
Knife	10	450	500	4.0	5.1
Cutlass	7	1100	1500	3	25.6
Hoe	5	1050	1300	3	66.7
Total	-	-	-	-	100

Source: Field Survey, 2015.

Table 4.2.4 Use of Non-Labour Inputs by Farmers.

Fertilizer Users	**Percentage of Farmers**
NPK Users	53.4
Urea Users	5.2
Non-Usersof Fertilizer	41.4
Total	100
Manure Users	
Manure Users	36.2
Non-users of manure	63.8
Total	100
Herbicides Users	
Herbicide Users	24.14
Non-Users of herbicides	75.86
Total	100

Source: Field Survey, 2015.

In addition about 36 percent of entire farmers applied manure on their farms during the year. Expenditure on manure showed that the average quantity of manure applied per farmer was 818.5kg. The cost per unit of manure was about ₦127 while the total expenditure on manure was about ₦103,999. Use of herbicides was limited to few farmers during the year under consideration. About 24 per cent of the farmers applied the input. Average quantity used per farmer was very marginal, about 8 kilogramme. Cost per unit was ₦1, 267 and the total cost of herbicides used per average farmer was ₦10,640.

What can be deduced from the results in Table 4.2.4 is that the use of improved non-labour inputs was limited to few farmers, while majority of them are non-users. Even the quantity applied by the few farmers using each of the improved inputs was very low. The results obtained confirmed the fact that smallholder agriculture in Nigeria has been characterized by inadequate use of yield-enhancing practices and technologies. Yield-enhancing practices include mechanization, use of agrochemicals, fertilizers and pesticides, and increased use of irrigated land. The use of these practices and technologies is low in Nigeria. This, at least, partly explains why cassava yields in Nigeriaare far below average yields in other parts of the world as indicated earlier in Table 1.4. The results are indication of the fact that tractor ploughing and use of other modern inputs are confined to areas with large-scale farms. The limited use of these technologies among the smallholders coupled with poor agricultural practices implied undercapitalization, weak knowledge base and low productivity of land and labour.

Sources of Water for Irrigation

Although cassava can tolerate drought, water for irrigation is important for increased production particularly in the northern part of Nigeria where rainfall is low. As shown in Table 4.2.5, about 53 per cent of the farmers obtained their water for irrigation through unspecified sources. About 35 per cent claimed that they obtained their water for irrigation through private supply. About 6 per cent each obtained water through cooperative and government. This implies that government effort at assisting cassava farmers with irrigation has been limited and low since majority of them obtained irrigation water through other sources.

Constraints Associated with Farm Irrigation

With regards to constraints associated with irrigation of farms, Table 4.2.6 showed that about 55 percent of farmers

Table 4.2.5 Sources of Water for Irrigation.

Sources	Percentage of Respondents
Government Supply	5.9
Private Individual Supply	35.3
Cooperative	5.9.
Others unspecified	52.9
Total	100

Source: Field Survey, 2015.

Table 4.2.6 Challenges of Farm Irrigation.

Constraints on Irrigation	**Percentage of Respondents**
Untimely Water Release	54.5
Lack of Access to Irrigable land	45.5
Total	100

Source: Field Survey, 2015.

were confronted with challenges of untimely water release while 46 per cent of the respondents lamented about lack of access to irrigable land. These findings showed that government efforts on provision of water for irrigation and access to irrigable land by farmers have been hampered by some problems. The rating of the problems limiting the effectiveness of irrigation facilities are discussed in the subsequent sub-section.

Rating of the Importance of Constraints to Irrigation

Factors that constrained irrigation were further rated. As shown by table 4.2.7, the specific factors included untimeliness in water release, lack of access to irrigable land, conflict relating to pastoralists, inadequacy of water, as well as salt built-up on the land. These were the major limitations that opposed the farmers on irrigation. Regarding untimeliness of water release, majority of the farmers, about 52 per cent rated the factor as very important while another 26 per cent rated it as important. In the case of lack of access to irrigable land, about 41 per cent of the farmers rated it as very important. Regarding conflict relating to pastoralists, about 47 per cent of the farmers rated the factor as very important. On the inadequacy of water, an overwhelming percent of the farmers, 88 per cent rated the factor as very important. In the case of salt built-up on the land, majority of the farmers, about 59 per cent rated it as not important. The results revealed that the most critical challenge confronting the farmers on irrigation was inadequacy of water. The next important challenge was untimeliness of water release. This was followed by conflict relating to pastoralists, and lack of access to irrigable land.

Access and Benefits Derived from Extension Services

Extension is an important factor that impacts positively on productivity of farmers through education, awareness and adoption of innovative technology being introduced to the farmers. In this connection, the results presented in Table 4.2.8 revealed that majority of the cassava growers; about 69 per cent did not have access to any extension services. This is contrary to the much acclaimed success of government effort on agricultural extension services in Nigeria. Among the 31 per cent of the cassava growers that had access to extension, about 44 per cent of them claimed that they have learnt new method of farming. Similarly another 13 percent learnt about modern farm practices. These benefits that they have gained would influence positively their output levels.

Output and Yield of Cassava per Farmer

The key constraints to increasing productivity per farmer were mainly inadequate use of yield-enhancing technology as reflected by non-use of mechanization, inadequate use of agro-chemicals, as well as inadequate investments in irrigation. The results in Table 4.2.9 showed that average area planted per typical cassava farmer was 1.40 hectares and the output realized by the farmer was 14.8 tonnes. This resulted into a yield of 8.5 tonnes per hectare which was lower than the yield obtained from comparative countries like Cambodia and Thailand where the yields were 22.86 tonnes and 21.82 tonnes per hectare, respectively, as at 2013. Reasons for the low yield of cassava among the smallholder farmers in Nigeria can be adduced from the earlier results. Evidences from the earlier results are indications of low applications of improved non-labour inputs which were confined to few farmers. Majority of the farmers were non-users of fertilizers, herbicides and manure. Furthermore, significant proportion of the farmers also lamented about lack of access to irrigable land in which majority of them rated it as a serious problem. Similarly an overwhelming proportion of the farmers rated inadequacy of water as a very critical constraints to irrigation system.

Table 4.2.7. Rating of Importance of Factors Limiting Farmers in the Use of Irrigation System.

Nature of Constraints.	Percentage of Respondents
Rating of Untimeliness of Water Release	
Very Important	51.9
Important	25.9
Non Important	22.2
Total	100
Rating of lack of access to Irrigable Land	
Very Important	41.2
Important	25.9
Non Important	35.3
Total	100
Rating of conflict Relating to Pastoralists	
Very Important	47.1
Important	11.8
Non Important	41.2
Total	100
Rating the inadequacy of Water	
Very Important	88.2
Important	11.8
Total	100
Rating of salt built up on the Land	
Very important	29.4
Important	11.8
Not important	58.8
Total	100

Source: Field Survey, 2015.

Table4.2.8. Extension Services and Benefits to Farmers.

Extension Services	Percentage of Respondents
Access to Extension Services	
Yes	30.9
No	69.1
Total	100
Benefits Derived from Extension Services	
Motivation through information Dissemination	25.0
Education on Method of farming	43.8
Introduction of modern farm Practices	12.5
Supply of Inputs	6.3
Technical Assistance and Advise	6.3
Prompt Delivery of inputs	6.3
Total	100

Source: Field Survey, 2015.

Moreover, majority of the cassava growers did not have access to any extension service. The cumulative effects of the observed inadequacies in the production system are manifestations of low output and low yield per typical cassava farmer.

Financial Costs and Profitability Indicators of Cassava Production

Both the magnitude and structure of financial costs and profitability are important in the analysis of the performance of farmers. The magnitude of cost will affect the efficiency of the farmers while the structure will provide the opportunity to identify specific cost items that can be targeted by farmers in a bid to improve their efficiency and performance.

Financial Costs and Profitability Indicators

On the basis of data adequacy, Table 4.3.1 showed the magnitude of cost and profitability of an average cassava grower at the small scale level per metric tonne of output. The data in the Table revealed that cassava production per metric tonne of product at the farm level is profitable. At the production stage, total production cost per metric tonne of cassava output was ₦28,296.76.

Table 4.2.9. Output and Yield Realized Per Farmer.

Statistics	Area Planted in Hectare	Output in Kg	Yield in Kg per Hectare
Minimum	0.18	150	150
Maximum	4.0	300,000	30,000
Mean	1.4	14883.83	8,506.38

Source: Field Survey, 2015.

Table4.3.1. Indicators of Costs and Profitability of Cassava Production in Nigeria, Per Metric Tonne of Output at Small Scale Farm level.

Category	**Small Scale Farm Level Production per Metric Tonne** NGN
Variable Cost Components:	
Planting Material Cost	114.81
Cost of Manure	1656.34
Cost of Fertilizer	2327.30
Cost of Herbicides	1975.35
Cost of Insecticides	892.96
Total Labour Cost	961.68
Total Marketing Cost	881.63
Water Charges for Irrigation	541.19
Transportation Cost	554.22
Total Variable Cost(TVC)	9905.48
Fixed Cost Components:	
Rent Cost	5422.31
Depreciation of Tools	3495.77
Interest paid	9473.20
Total Fixed Cost (TFC)	18,391.28
Total Cost (TC)= TVC +TFC	28,296.76
Profitability Indicators:	
Gross Revenue(Quantity of Output multiplied by Price of Output)	43740.00
Gross Margin= GR-TVC	33834.52
Net Profit= GR-TC	15443.24
Gross Rate of Return= GM/TVC	3.42
Net Rate of Return =NP/TC	0.55

Source: Author‘s Computation

The total cost consists of ₦9,905.48 as variable cost and ₦18,391.28 as fixed cost component. On the basis of the gross revenue realized per metric tonne of output, profitability indicator was ₦43,740. Gross margin and net profit per metric tonne of cassava output at the farm level were positive. The gross margin at the farm level was ₦33,835 while the net profit was ₦15,443. In terms of rates of returns, the net rate of return was 55 per cent on the basis of net profit. The net rate of return of 55 per cent implies that for every one naira (100 kobo) invested in cassava production by an average cassava farmer at the small scale level, there is a net profit of 55kobo.

Structure of Financial Costs

The structure of financial costs incurred by an average cassava grower at small scale level is summarized in Table 4.3.2. The table revealed twelve factors are important in determining the total cost of production. On the basis of the percentage share in the total production costs, the factors in order of importance included interest paid on credit, rent, depreciation of tools and equipments, fertilizer, herbicides, manure, labour, insecticides, marketing, transportation, water charges for irrigation and planting materials. Among the twelve factors, interest paid on credits constituted the highest share of the total cost, followed by rent, depreciation of tools, fertilizer, herbicides and manure. About 33 per cent of the total cost goes to interest paid on credit. The cost of rent constituted about 19 per cent, depreciation took about 12 per cent. About 8 per cent goes to fertilizer, 7 per cent goes to herbicides while 6 per cent goes to manure.

Major Point of Selling Products

Table 4.3.3 revealed that majority of the farmers about 66 percent of them sold their products on the farm while only 40 percent transported their products to the major market. This can be as a result of high transportation cost and bad road which can lead to accident and wastage of their transported products

Income per person in the Household in a Production Season

Table 4.3.4 showed the income earned from cassava production per person in the cassava farming household in a production season. The results showed a very low income level of N32,827.92 which is equivalent to $205 per person in a production season in the household with an exchange rate of N160 to a dollar as at 2015. The level of income generated per typical cassava farmer cannot bring about poverty reduction and the required huge capital investment for commercial level of production that would lead to industrial and commercial application of cassava. This means that if the desired objectives of transforming cassava sector would be achieved, consolidation of fragmented landholdings and easy access by smallholder farmers to credit and yield enhancing practices and modern technology are necessary.

Determinants of Production and Profitability

Table 4.4.1 showed the estimated parameters and the results of related statistical tests of the model specified for determinants of production and profitability of cassava. As depicted in the Table the result is a good fit of the data as judged by the adjusted coefficient of determination (Adjusted R^2) in each of the equation of the model. On the basis of the statistical significance of the variables and the adjusted coefficient of determination, the Linear function was selected as the lead equation for the model that explained the relationship between the net profit and the independent variables while double-log function was selected for the model that explained the relationship between the output of cassava and the independent variables.

For the estimated linear function, Table 4.1.1 indicates that the independent variables explained 67 percent of variations in net profit that accrued to farmers and the F-Statistics confirmed that the result was a good fit being significant at the 5 per cent level. Regarding the estimated double-log function, the adjusted coefficient of determination indicated that the independent variables explained 57 per cent of the variation in output of cassava and the F-statistics also confirmed that the result was a good fit being significant at the 5 per cent level. The results conformed to theoretical expectations. The parameters are discussed as follows.

Determinants of Profitability

As shown in Table 4.4.1, only three variables are significant determinants of net profit realized by a typical cassava farmer. These are area planted to cassava, man-days of labour used and marketing cost incurred by the farmer.

Area Planted to Cassava: The estimated coefficient of the area planted to cassava is positive and significant at the 5 percent level. This implies that the larger the area planted, the higher the net profit level realized by the farmer.

Man-days of Labour Used: The estimated coefficient of the man-days of labour used is negative and significant at the 5 per cent level. This means that as the man-days of labour used increases, net profit decreases. This is plausible because increasing man-days of labour has the tendency to drive up the cost of labour which will exert a dampening effect on the level of profit realized by the farmer.

Marketing Cost: The estimated coefficient of the marketing cost is negative and significant at the 5 per cent level. This implies that the higher the marketing cost, the lower the net profit realized. This is consistent with the finding that about 66 percent of farmers sold their products on the farm due to high transportation cost and bad road which can lead to accident and wastages of products. Only 40 percent of farmers do transport their products to the major market. This is supported by three most pressing challenges mentioned by the farmers which are bad roads, lack of modern mechanized equip-

Table 4.3.2. Structure of Financial Costs of Cassava Production per Metric Tonne.

Cost Components	Percentage of Total Cost	Ranking
Variable Cost Components		
Planting Material Cost	0.41	12th
Cost of Manure	5.85	6th
Cost of Fertilizer	8.22	4th
Cost of Herbicides	6.98	5th
Cost of Insecticides	3.16	8th
Total Labour Cost	3.40	7th
Total Marketing Cost	3.12	9th
Water Charges for Irrigation	1.91	11th
Transportation Cost	1.96	10th
Total Variable Cost(TVC)	**35.01**	
Fixed Cost Components		
Rent Cost	19.16	2nd
Depreciation of Tools	12.35	3rd
Interest paid	33.48	1st
Total Fixed Cost (TFC)	**64.99**	
Total Cost (TC)= TVC +TFC	100	

Source: Author's Computation

ment and high cost of farm labour. Among the three most pressing challenges, bad road predominates in which the highest proportion of the farmers complained about.

Determinants of Cassava Output

Regarding the output of cassava, three variables are significant determinants of the cassava output. These are area planted to cassava, marketing cost incurred and the age of the farmer.

Area planted to Cassava: The estimated coefficient of the area planted to cassava is positive and significant at the 5percent level. The magnitude, 0.48 shows that the output supply of cassava is inelastic to changes in its area planted meaning that a unit change in area planted to cassava will result in less than a proportionate change in output supply of cassava. A 10 per cent increase in area planted to cassava will bring about an increase of 4.8 percent in output supply of cassava. This could be explained by inadequate application of yield enhancing practices and lack of access and use of modern farm technology such as mechanization and irrigation.

Marketing Cost: The coefficient of marketing cost is negative and significant at the 5 per cent level. The magnitude 0.55 implies that a 10 percent increase in marketing cost will lead to 5.5 percent decrease in output supply of cassava. Thus increasing marketing cost exerts a dampening effect on cassava production. This is consistent with our earlier finding that a dominant constraint to marketing and production of cassava was bad road. The bad road made farmlands difficult to access. In this way farmers would find it difficult to bring inputs needed to expand their production. Similarly they would find it difficult to transport their farm products to urban markets which would eventually lead to post-harvest losses and thus significant loss in cassava output.

Age of the Farmer: The coefficient of the age of the farmer is negative and significant at the 5 per cent level. The magnitude -0.38 implies that a 10 per cent increase in the age of the farmer will lead to 3.8 per cent decrease in output of cassava. Thus increasing age exerts a negative effect on cassava production. This is consistent with the earlier findings that the farmers are aging with majority that fell within declining productivity age category and they mostly rely on crude and hand powered implement that requires energy and strength to apply on the farm. Thus the significant factors that determine the level of cassava production and profitability are area planted to cassava, man-days of labour used, marketing cost and age of the farmers. In this regard policy strategies to enhance cassava production and profitability must adequately give special attention to the management

Table 4.3.3. Where farmers sell their Products.

Point of Selling	Percentage of Respondents
Selling on Farm	65.5
Market	34.5
Total	100

Source: Field Survey,2015.

Table4.3.4. Income per Person per Production Season in the Cassava Farming Household.

Net Profit Per Tonne Per Farmer in Naira	15,443.24
Mean Output Realised Per Farmer in Tonnes	14.88
Mean Household Size	7
Total Income Realized per farmer in Naira	229,795.41
Per capita income in Naira	32,827.92
Household Per capita Income in Dollar(N160 to a dollar as at 2015	205

Source: Author's Computation.

of these factors.

Challenges Encountered by Farmers and Solutions Proffered

The challenges encountered by farmers relate to the production as well as to the marketing of their outputs. Promoting agricultural investment and productivity requires improved market access and adequate service infrastructure, including better road networks, communication, rural electrification and water supply. For improved agro-industrialization and domestic and regional trade, the key prerequisites are competitive power and road/rail freight tariffs.

Several issues emerged including high cost of labour and bad road. Bad roads make farmlands difficult to access. Most roads in the rural areas are unpaved and impassable during the wet seasons. Improvement of domestic and regional roads has great potential to reduce transportation costs, increase overland trade and enhance the global competitiveness of Nigerian agriculture. The proposed trans-Africa road network connecting cities of over 500,000 people should be implemented. Apart from low road density coverage, road freight tariffs are quite high in Nigeria compared with other developing regions.

The farmers also complained of inadequate farm land in some cases, while others complained of pest attack, and lack of technical know-how. Other problems mentioned by farmers included invasion of farms by pastoralists with their cattle, low demand, high cost of inputs, lack of extension services, late arrival of fertilizer on the farms, and unfavorable government policies. The challenges encountered by the farmers are summarized in Table 4.5.1. The table enables us to appreciate how respondents viewed the severity of the challenges in the country. The three most pressing challenges mentioned are bad roads, lack of modern mechanized equipment and high cost of farm labour. Among the three most pressing challenges, bad road predominates in which the highest percentage of farmers complained about.

Moreover, about 16 per cent of the farmers suggested the need for increased agricultural loans for cassava farmers to enable them expand their scale of production. Farmers are willing to produce as long as they are assured such produce will be bought. They are discouraged when they have to bear losses of crops produced due to lack of buyers.

The farmers gave suggestions on how to address these challenges. The suggestions offered by the farmers are summarized in table 4.5.2. In line with the major challenge highlighted, the farmers suggested government intervention on provision of inputs and irrigation. About 22 per cent of the farmers gave this suggestion. In addition, about 22 per cent of the farmers crave for provision of good roads to make farms more accessible and enhance farm to market trips.

Policy Implications and Conclusions

Policy Implications

Emerging findings showed that three variables are significant determinants of cassava output. These are land area planted to cassava, marketing cost and age of the farmer. The nature of the effect of cultivated land area on output was positive implying that policy that will enhance land productivity and expand yield per hectare is necessary. This should include land consolidation policy that should be directed at removing problem of land

Table4.4.1. Regression Estimates of Determinants of Cassava Production and Profitability in Nigeria.

Dependent Variable Net Profit				**Dependent Variable Quantity of Cassava Output**			
Independent Variables	**Linear Function**	**Semi-Log Function (Independent variables are logged)**	**Double-Log Function (both dependent and independent variables are logged)**	**Independent Variables**	**Linear Function**	**Semi-Log Function (Independent variables are logged)**	**Double-Log Function (both dependent and independent variables are logged)**
Constant	-111182.52 (-1.231)	1284418.62 (0.55)	6.80 (1.54)	Constant	-997.11 (-0.18)	-60951.92 (-1.25)	5.61 (2.59)
Area Planted	0.58 (4.37)*	0.58 (3.28)*	0.25 (1.55)	Area Planted	0.44 (4.09)*	0.56 (3.01)*	0.48 (3.18)*
Labour Mandays	-0.39 (-3.08)*	-0.54 (-2.99)*	0.52 (3.15)*	Labour Mandays	-0.01 (-0.12)	-0.07 (-0.38)	0.20 (1.44)
Marketing Cost	-0.24 (-1.82)**	0.30 (1.53)	-0.44 (-2.82)*	Marketing Cost	-0.69 (-6.58)*	-0.56 (-2.93)*	-0.55 (-3.84)*
Age		-0.16 (-0.71)	-0.23 (-1.46)	Age	-0.05 (-0.51)	0.09 (0.41)	-0.38 (-2.46)*
Fertilizer		0.34 (1.47)		Fertilizer		0.04 (0.20)	
Adjusted R Squared	0.67	0.69	0.68	Adjusted R Squared	0.78	0.63	0.57
F Statistics	34.96(Significant at 5%)	36.3(Significant at 5%)	48.9 (Significant at 5%)	20.59(Significant at 5%)		35.40(Significant at 5%	38.34(Significant at 5%)

Source: Author's Computation.

fragmentation coupled with the use of yield-enhancing farm practices and modern technology such as mechanization to expand land productivity. This should be combined with effective extension system and government intervention on provision of improved inputs and irrigation facilities. Negative effect of marketing cost implies the need to cut down or reduce cost of marketing. This is possible through adequate provision and rehabilitation of rural roads that are in a deplorable conditions as well as provision of efficient transportation system by the government in the rural sector. Negative effect of age of farmers on cassava output implies the need to mobilize and stimulate young and dynamic age group to embrace cassava production through provision of incentives. This could be done by providing enabling infrastructures and modern technology in the rural sector. This should include road, electricity and water that could curtail rural to urban migration of the youth and catalyze rural industrialization.

Three factors that significantly determined net profit or income realized by a typical cassava farmer are land area planted, man-days of labour used and marketing cost incurred. The implication is the need to promote labour saving farm practices so as to reduce the high cost of farm labour. This should include substitution of hand powered tools and equipment with mechanized and motorized machines and equipment that can be easily adopted and affordable by the farmers. This should be massively produced by the government through application of science and technology in the relevant Research Institutes. High cost of farm labour could be reduced by the farmers through application of improved inputs such as herbicides. Negative effect of marketing cost on net profit can be reduced through efficient road networks and transportation system that will provide effective linkage of farmers to industry and urban markets. Access to agricultural loans and funds should be strengthened by sustaining and expanding the effort directed at giving loans to farmers at single digit interest rate. This could catalyze the use of non-labour improved inputs and modern technology.

RECOMMENDATIONS

Promote Sustainable Agricultural Production Systems

Agricultural production has to a large extent been based on increasing the area cultivated to meet the demand for an increasing population in Nigeria. This strategy is a technique that is predisposed to environmental degradation. There is therefore a need to promote sustainable agricultural production based on increased

Table 4.5.1. Major Problems Being Encounteredby Cassava Farmers.

Major Problem Faced	Percentage of the Respondent
Market Competition	1.8
Bad Road	21.4
High Cost of Farm Labour	8.9
Late Supply of Fertilizer	3.6
Lack of Modern Mechanized Equipment	19.6
Lack of Technical Know-How	5.4
Low Demand	3.6
Pest Attack	7.1
High Cost of Input	3.6
Inadequate farm land	8.8
Cattle Grazing Farm	5.4
Lack of Extension services	3.6
Unfavourable Government Policy	1.6
Buying on Credit	1.6
Total	100

Source: Field Survey, 2015.

Table4.5.2. Suggestions on ways of addressing the Problems Faced by Farmers.

Suggested Ways to Address the Problem	**Percentage of the Respondent**
Provision of Modern Agric Equipment	11.8
Provision of Good Road	21.6
Access to Agric Loan/Fund	15.7
Early Provision and subsidy of Fertilizer	7.8
Government Intervention on provision of inputs and irrigation	21.7
Regular Visitation of Extension Agents	3.9
Investment on Large Scale Production	5.9
Provision of Commodity Marketing Board	2.0
Government should Regulate Price	2.0
Storage facilities	5.9
Prompt payment by customers on products purchased.	2.0
Total	100

Source: Field Survey, 2015.

productivity, while protecting the environment. This requires:

- Increasing irrigated land from the current level to at least 10 per cent of arable land
- Addressing land policy issues, especially land consolidation, security of tenure and equitable land distribution;
- Improving water management through the protection of water sources, conflict resolution, and enhancement of water utilization systems and quality;
- Improving human capital stock by providing access to health facilities, basic education and extension services to farmers aimed at promoting sustainable agricultural production.

Increase use of yield-enhancing practices and technologies

As Nigeria lags behind in the use of yield-enhancing technologies, it is necessary that proactive policies be implemented to promote their use as follows:

- Increase fertilizer use from the current low levels to increasingly aim to reach the world average.
- Increase the comparatively low use of tractors to at least the level in other developing regions such as East Asia.
- Increase the use of improved seeds to enhance yields and output.

Boost investment in soil and water conservation

Governments should:

- Ensure that national agricultural development strategies place emphasis on soil and water conservation measures rather than on expansion of cultivated land;
- Create incentives and enabling environments for communities and individual farmers to adopt soil and water conservation measures.

Improve Marketing and Rural infrastructure

Improved rural infrastructure and marketing are essential for

Nigeria to enhance the competitiveness of cassava products. To do so the government needs to:

- Increase road densities in rural areas from the current low level to 134 km/1,000 km^2, which is comparable to those of other developing regions, in order to lower road freight tariffs, which are much higher in Nigeria than elsewhere in the world;
- Increase electricity coverage and supply as in other developing regions, and lower power tariffs to encourage increased use by micro, small and medium agricultural enterprises, agro-industries and farmers.

Create Incentives for the Youth

- Government should empower the category of the young age group with modern machines and machineries coupled with single digit interest credit packages for production and processing.
- Government should buy cassava products from farmers for food storage against off-season and period of famine. In this way instability in prices would be reduced and post-harvest wastages of cassava products will be curtailed and the problem of lack of buyers will be solved.
- Improved and high yielding cassava variety should be developed by relevant research institutes and distribute to young farmers so as to raise the current yield of cassava per unit land area.

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