Allocative Efficiency of Resource Use by Cassava Farmers  
in Wamba Local Government Area, Nasarawa State,  
Nigeria  

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ABSTRACT  
The national policy objective of substituting wheat with cassava to cut down on  
food import bill can only be achieved by enhancing the productivity of cassava  
farmers who are mainly small scale farmers. But critical to output growth is  
resource-use efficiency. Efficiency of resource-use enhances farm productivity,  
guarantee food security and consequently poverty reduction. Thus, in attaining  
the aforementioned policy objective it is only imperative to ascertain the resource-  
use efficiency of this category of farmers. It is against this backdrop that this  
survey is carried out to evaluate the allocative efficiency of resource use by  
cassava farmers in Wamba Local Government Area of Nasarawa State, Nigeria.  
This was achieved by ascertaining the socio-economic characteristics of these  
farmers and estimating their production function to provide coefficients for  
determining the allocative efficiency of resource-use. Data were generated through  
the administration of questionnaire to 126 randomly selected farmers in the five  
villages purposely selected. The findings reveal that resources that account for  
over 80 per cent ($R^2$) variation in output are underutilized and this was discovered  
to be at variance with the national policy objective on cassava production. It is  
therefore recommended among others that: agricultural credit should be readily  
available, training and retraining programmes for farmers, and adequate funding  
of research institutions.  

Keywords: Allocative Efficiency, Resource Use and Cassava Farmers  

INTRODUCTION  
Cassava is the third most important food source in tropical countries with over 500 million  
people relying on it as their main source of calories with subsistence farmers in sub-Saharan  
African countries in the majority (IITA, 2011). Apart from being a major source of calories,  
cassava’s derivatives are applicable in many types of products such as confectioneries,  
monosodium glutamate, drugs, amongst others. As an energy derivative, cassava has been  
found and shown by the US Department of Agriculture to be more efficient in the production  
of ethanol, yielding double or triple the amount of carbohydrate for ethanol production that  
is found in field corn. The discovery of its capacity to also act as substitute for wheat has  
generated anxiety in the Nigerian federal government policy formulation matrix.  

Nigeria currently imports wheat worth N635 billion annually basically for bread  
production (Adesina, 2011). It is argued that including 50 per cent cassava flour in wheat  
flour will save Nigeria over N315 billion food import bills, contribute in the reduction of  
the worsening rate of unemployment and consequently reduce poverty through the value  
chain mechanism. In 2002, Nigeria adopted a policy compelling flour millers to implement
10 per cent cassava flour into wheat flour and this have resulted in increases in cassava production from the tone of 37 million metric tons as at 2010 (FAO, 2011) to 45 million metric tons as at 2012 (FMARD, 2012). The present administration is poised to double this figure by making production demand driven. But agriculture in Nigeria is dominated by the prevalence of small scale farmers who account for over 90 per cent of the total agricultural output (Olayide, 1990; Ehilebo and Okon, 2009). Allocative efficiency deals with the extent to which farmers make efficient decisions by using inputs up to the level at which their marginal contribution to production value is equal to the factor cost (Akinwumi and Djato, 1997). Chirwa (2003) opined that it reflects the ability of a farm to use inputs in optimal proportions given their respective prices and the production technology. Under competitive conditions, a farm is said to be allocatively efficient if it equates the marginal returns of factor inputs to the market price of output (Fan, 1999).

Allocative efficiency of resource use is critical to enhanced productivity and incomes. The major goal of any production system is the attainment of an optimally high level of output with a given amount of effort or input. In the attainment of optimal level of output, resource productivity is pivotal. Thus, efficient utilization of resources is also instructive in achieving broad-based economic growth. Agricultural growth however, is a catalyst for broad based economic growth and poverty reduction especially in most low-income countries (Amalu, 2005). The national policy of doubling the production of cassava so as to cut down on wheat importation will not only reduce the country’s food import bill but will promote food security and in the process alleviate poverty through the value-chain mechanism.

In addressing the above national policy objective, it is only imperative to focus search light on the activities of these small scale farmers by determining how efficient is their resource use in the production of the much valued crop-cassava. In achieving this, States or regions that appear to have comparative advantage should be isolated and resource use efficiency of farmers examined to ensure greater productivity. Nasarawa State happens to be one of the States known for the production of cassava and Wamba Local Government Area is among the leading producers of cassava in the state. It is against this backdrop that this study is carried out to determine the allocative efficiency of resource use of these farmers. The aim of this study was achieve by ascertaining the socio-economic characteristics of these farmers and estimating their production function to provide coefficients for determining the allocative efficiency of resource-use.

METHOD

This study was carried out in Wamba Local Government Area of Nasarawa State, Nigeria. The local government lies between 8.93333°N and 8.60000°E. It has an area of 1,156km² and a population of 72,894 at the 2006 population census (NPC, 2006). It shares boundary with Kaduna State in the north and Plateau State in the east. It has rich fertile soils from the loosed soil material of alluvial deposits in lower areas of the Farin-Ruwa waterfalls and undeveloped soils on hills slopes and entrenched river valleys. The Local government is
characterized by a tropical sub-humid climate with two distinct seasons; the wet and the dry season. Annual rainfall figure ranges from 1100mm to about 2000mm. A single maximum temperature is achieved in March of 39°C. The relative humidity varies from 40% to 88% with an average of 63%. Agriculture is the major occupation and the main crops grown are cassava, yams, rice, cocoyam, maize, beans, groundnuts, acha, and vegetables. Households also keep livestock such as sheep, goats, pigs, poultry, etc. The selection of sample involved a multistage sampling technique in which five villages namely Gwagi, Gwata, Sisimbaki, Wayo and Konva were purposely selected from Wamba Local Government Area. Secondly, Households were randomly selected on the basis of the community’s population size using a constant sampling fraction of 1% in order to make the sampling design to be self-weighting thereby avoiding sampling bias (Eboh, 2009). Based on the foregoing criterion, 126 farmers were randomly selected cutting across the five villages marked for the study. Data were collected in the 2010 cropping season. The data collected were mainly from primary sources and obtained through the use of structured questionnaire that were administered to the selected 126 cassava farmers in the study area. Data were analysed through descriptive statistics and regression analysis.

In modeling farm production, the production function is a virile tool to use. The production function is the technical or physical relationship between input and output, estimated for further analysis of technical and economic maximum of output in a production process. When the economic maximum is established, resource-use efficiency can be determined. There are various forms of production function that could be used to analyze agricultural production generally (Heady and Dillon, 1981). However, a general form may be specified for cassava farmers in the study area taking into account the nature of crop, environment and the peculiar category of the farmers. Suppose the output of cassava \( q_i \) of each farmer in the study area is a function of farm size \( fs \), Labour \( Lb \), Stems \( sm \), and Capital \( k \). The implicit form of the model can be stated thus:

\[
Q = f(X_1, X_2, X_3, X_4, e)
\]

Where

- \( Q \) = output of cassava
- \( X_1 \) = farm size,
- \( X_2 \) = Labour,
- \( X_3 \) = stems (measured in kg),
- \( X_4 \) = capital
- \( e \) = error term

It is expected \textit{a priori} that the coefficients of \( X_1, X_2, X_3, X_4, e > 0 \).

Four functional forms of the multiple regression model; linear, semi-log, Cobb-Douglas and exponential were estimated and a lead equation selected. The functional forms were expressed in their explicit forms as:

\[
Q = b_o + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + e
\]

\[
\text{Ln}Q = \ln b_o + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + e
\]

\[
Q = a_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + e
\]

\[
\text{Ln}Q = a_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + e
\]

)(Linear) (Cobb-Douglas) (Semi-Log) (exponential)
Where:

\[
\begin{align*}
    b_0 &= \text{constant} \\
    b_1 - b_4 &= \text{estimated regression coefficients} \\
    X_1 - X_4 &= \text{independent variables}
\end{align*}
\]

The Cobb-Douglas production function was chosen as the lead equation having satisfied the econometric criteria of possessing the best fit, highest number of parameter estimates that are statistically significant, as well as expected signs of the estimated parameters. The input-output relationship as expressed by the production function is important for the measurement of allocative efficiency of resource-use. Allocative efficiency has to do with a firm’s/farm’s ability to use the inputs at its disposal in optimal proportions given their respective prices and the available production technology. In other words, it is the farmers’ ability to produce a given level of output using the cost minimizing input ratios (Asogwa, Umeh and Penda, 2011). The ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC) is the measurement for allocative efficiency of resource-use (AER).

\[
\text{AER} = \frac{\text{MVP of a factor input}}{\text{Price of the factor}}
\]

But

\[
\begin{align*}
    \text{MVP}_{Xi} &= \text{MPP}_{Xi} \cdot P_{Xi} \\
    \text{MVP}_{Xi} &= \text{Marginal Value Product of a factor} \\
    \text{MPP}_{Xi} &= \text{Marginal Physical Productivity of a factor (In the case of the Cobb Douglas function, the } \text{MPP} \text{ are the direct elasticities of production-parametric values)} \\
    \text{P}_{Xi} &= \text{Unit price of a factor or the opportunity cost of the factor.} \\
    \text{AER} &= \text{Allocative Efficiency Ratio}
\end{align*}
\]

**Decision rule**

- If \( \text{AER} = 1 \), resource is efficiently utilized
- If \( \text{AER} > 1 \), resource is under utilized
- If \( \text{AER} < 1 \), resource is over utilized

The use of this ratio in determining allocative efficiency enjoys rich support in literatures (Agom, Ohen, Idiong and Oji, 2009; Rahman and Lawal, 2003)

**RESULTS AND DISCUSSION**

**Socio-economic characteristics of respondents:** From the socio-economic profile of farmers on table 1, males constituted the majority of cassava farmers in the study area with 86.50% of total respondent as against females with 13.50%. Females were less involved because of the high labour requirements and land ownership pattern which favour the males. Most of the respondents were aged 41-50 years while 31.72% of them were aged between 31-40 years. The mean age of the farmers was about 43.4 years implying that the farmers were at their active stage of life to produce the needed quantities of output if given the enabling environment such as inputs support. Also, the youthful nature of most of the farmers may be an advantage to innovation, since youths are said to be less risk averse...
and may have better exposure to new ideas. Majority of the farmers had 9 – 12 persons in their families with a mean family size of 9 persons. These large family sizes are advantageous in labour supply for agricultural output production. On farm size, majority of the farmers had farm sizes of 0.6 – 0.1 hectares, 26.19 per cent had above 1 hectare while the mean farm size was 0.79 hectares implying that most of the sampled farmers are small scale farmers. On the distribution of farmers based on their farm incomes, most farmers earned an annual income of N50,000 – N100,000 with only about 7% earning above N150,000 per annum. The mean annual farm income was N89,141.97 which is less than N8,000 per month in spite of large families which they supported. The marginal propensity to consume the produce of these farmers far exceeds their propensity to save making the generation of financial capital almost impossible. This further perpetuate the vicious cycle of poverty that had engulfed these farmers. The educational level was low as a total of 71.42% had either no formal education training or had only attended primary school. This is bound to have adverse effect on their resource use efficiency and income generating ability.

**Estimation of Production Function:** From table 2, the study reveals that about 87.7% of the total variation in output was explained by the factor inputs included in the model. All explanatory variables under the Cobb- Douglas function came out with the expected positive sign. These positive coefficients imply direct relationship between inputs and output and that increase in the quantity of one of these inputs holding others constant would increase the output. The relationship was significant at 1 per cent for farm size and stems and 5 per cent for labour and capital. Also, from table 2, cassava farming in the study area for the 2010 cropping season had output elasticities of farm size (X₁), stems (X₂), labour (X₃) and Capital (X₄), as 0.512, 0.161, 0.214, and 0.968. The sum of these elasticities is a measure of return to scale. For this study, the sum was discovered to be 1.855 implying that the farmers are operating under increasing returns to scale (since sum of elasticities is greater than 1). Again, the magnitude of these elasticities are reflections of the potentials of each input towards enhancing productivity. The study futher reveals that capital has the highest potential of 0.968 suggesting, holding other variables constant, a 10 per cent increase in capital requirement of these farmers will increase output by 9.68 units.

**Estimation of Allocative Efficiency:** To obtain the parametric measure of efficiency, a functional form of the production model is estimated to obtain the Marginal Physical Products (MPP) of each factor input. The Marginal Value Product (MVP) was divided by the Marginal Factor Costs (price of unit input) to ascertain if the inputs were used efficiently. Table 3 reveals the findings in that regard. Based on the decision rule specified above, farm size, labour and stems were under utilized by cassava farmers in the study area. The study area is rural in setting with inherited pattern of land ownership. Large portions of land within these areas are arable with insufficient labour to cultivate the farm lands. While the crave for city-life and white collar jobs is depriving rural agriculture of the most productive labour force, most children of farmers and graduates of agriculture are not attracted to agriculture.
Table 1: Socio-Economic Characteristics of farmers

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>109</td>
<td>86.50</td>
</tr>
<tr>
<td>Females</td>
<td>17</td>
<td>13.50</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>100</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 30</td>
<td>17</td>
<td>13.49</td>
</tr>
<tr>
<td>31 – 40</td>
<td>40</td>
<td>31.72</td>
</tr>
<tr>
<td>41 - 50</td>
<td>50</td>
<td>39.68</td>
</tr>
<tr>
<td>Above 50</td>
<td>19</td>
<td>15.10</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>100</td>
</tr>
<tr>
<td>Family size (No. of persons):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 and below</td>
<td>06</td>
<td>4.76</td>
</tr>
<tr>
<td>5 – 8</td>
<td>36</td>
<td>28.57</td>
</tr>
<tr>
<td>9 – 12</td>
<td>63</td>
<td>50.00</td>
</tr>
<tr>
<td>Above 12</td>
<td>21</td>
<td>16.66</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>100</td>
</tr>
<tr>
<td>Farm size (Hectares):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1 – 0.5</td>
<td>37</td>
<td>29.37</td>
</tr>
<tr>
<td>0.6 – 1.0</td>
<td>56</td>
<td>44.44</td>
</tr>
<tr>
<td>Above 1.0</td>
<td>33</td>
<td>26.19</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>100</td>
</tr>
<tr>
<td>Average annual income:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than N50,000</td>
<td>30</td>
<td>23.80</td>
</tr>
<tr>
<td>N50,000 – N100,000</td>
<td>50</td>
<td>39.68</td>
</tr>
<tr>
<td>N101,000 – N150,000</td>
<td>37</td>
<td>29.36</td>
</tr>
<tr>
<td>Above N150,000</td>
<td>09</td>
<td>07.14</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>100</td>
</tr>
<tr>
<td>Educational Attainment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>48</td>
<td>38.09</td>
</tr>
<tr>
<td>Primary school</td>
<td>42</td>
<td>33.33</td>
</tr>
<tr>
<td>SSCE/NECO/GCE</td>
<td>27</td>
<td>21.40</td>
</tr>
<tr>
<td>Post secondary</td>
<td>09</td>
<td>7.14</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2012

Table 2: Regression estimates, t-value and level of significance of the independent variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Regression Coefficient</th>
<th>Standard Error</th>
<th>t-value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm size ($X_1$)</td>
<td>0.512</td>
<td>0.118</td>
<td>4.399</td>
<td>0.01</td>
</tr>
<tr>
<td>Stems ($X_2$)</td>
<td>0.161</td>
<td>0.043</td>
<td>3.940</td>
<td>0.01</td>
</tr>
<tr>
<td>Labour ($X_3$)</td>
<td>0.214</td>
<td>0.117</td>
<td>2.196</td>
<td>0.05</td>
</tr>
<tr>
<td>Capital ($X_4$)</td>
<td>0.968</td>
<td>0.254</td>
<td>3.072</td>
<td>0.05</td>
</tr>
<tr>
<td>Constant</td>
<td>4.930</td>
<td>0.683</td>
<td>6.135</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Source: Adapted from Appendix B

Table 3: Marginal Physical Products and Marginal Value Products for farm size, stem and labour inputs in cassava production.

<table>
<thead>
<tr>
<th>Resources</th>
<th>MPP</th>
<th>MVP</th>
<th>MFC(#)</th>
<th>MVP/MFC</th>
</tr>
</thead>
<tbody>
<tr>
<td>farm size( ha)</td>
<td>14.081</td>
<td>14.081</td>
<td>1000</td>
<td>14.1</td>
</tr>
<tr>
<td>stems (kg)</td>
<td>0.851</td>
<td>34.06</td>
<td>25</td>
<td>1.36</td>
</tr>
<tr>
<td>labour (manday)</td>
<td>0.552</td>
<td>22.13</td>
<td>20</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Source: Author’s computation
GET
FILE = 'C:\Users\PIUS\Documents\Untitled1.sav'.
DATASET NAME Data Set 1 WINDOW = FRONT.
REGRESSION
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA
/CRITERIA = PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT y
/METHOD = ENTER x w q h.

Regression
[DataSet1] C:\Users\PIUS\Documents\Untitled1.sav

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.938</td>
<td>.877</td>
<td>.743</td>
<td>5.00960</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), X1, X2, X3, X4

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>4.936</td>
<td>.683</td>
<td></td>
<td>6.135</td>
</tr>
<tr>
<td>X1</td>
<td>.512</td>
<td>.118</td>
<td>.123</td>
<td>4.399</td>
</tr>
<tr>
<td>X2</td>
<td>.161</td>
<td>.043</td>
<td>1.126</td>
<td>3.940</td>
</tr>
<tr>
<td>X3</td>
<td>.214</td>
<td>.117</td>
<td>.116</td>
<td>2.196</td>
</tr>
<tr>
<td>X4</td>
<td>.968</td>
<td>.254</td>
<td>.807</td>
<td>3.072</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Cassava_yield

CONCLUSION AND RECOMMENDATIONS

Productivity increase in agriculture is an effective driver of economic growth and poverty reduction especially in the rural areas. Growth in agriculture is heavily dependent on efficiency of farm production. The inefficiency in farm production is a contributory factor to stagnation in agriculture resulting in soaring food import bills and consequently food insecurity. Though, Wamba Local Government Area is one of the leading producers of cassava in Nasarawa State, yet resources are still sub-optimally utilized by farmers as revealed in the study. This situation is in conflict with the policy objective of the Federal Government to not only double the current production of cassava in the country but in the long-run completely substitute wheat in bread production with cassava flour. The educational attainment of farmers, poor access to improved technologies among others appears to be factors mitigating efficient utilization of resources. To this end, the following recommendations are made in line with the findings of this research.

i. From the estimate of our production function, capital has the highest marginal productivity. This is an indication of the dire need of agricultural credit by these farmers. Provision of adequate agricultural credit will guarantee timely and adequate utilization of agricultural inputs for improvement in farm production efficiency.
ii. There is the need for training and retraining of farmers for improved quality of labour and management skills, training such as youth entrepreneurship in agriculture, agric-business, agricultural techniques among others to make sustainable livelihoods from agriculture.

iii. Agricultural research and technological improvements are requisites for enhanced agricultural productivity. The use of traditional tools in farming activities is still the common practice in most rural areas. Funding requirements for research institutes is highly recommended.

iv. Poor infrastructure affects cost of production and value of produce adversely and consequently farm production efficiency. Most rural settlements are isolated in Nigeria and are usually inaccessible during rainy seasons limiting access to inputs, new technologies and equipment. Rural development schemes should be reactivated and basic infrastructural provisions made.

v. Cost effective storage facilities for these farmers should be developed to make products readily available on demand. This is responsible for the cyclical glut in the local markets. Significant losses are still incurred due to bush fire and post-harvest losses resulting from lack of adequate storage facilities.

REFERENCES


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