



ANALYSIS OF TECHNICAL, ALLOCATIVE AND ECONOMIC EFFICIENCIES OF YAM PRODUCERS IN GANYE LOCAL GOVERNMENT AREA OF ADAMAWA STATE, NIGERIA

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Abstract:

The study investigated the technical, Allocative and economics efficiencies of yam producers in Ganye Local government Area, Adamawa State, Nigeria. Combinations of purposive and random sampling techniques were employed using 100 famers from five different wards of the local government. In the first place, five wards were selected and used for this study and twenty farmers were selected from each ward, making a total of 100 famers, twenty. The analytical tool used to achieve the objectives of this study was Data Envelopment Analysis. The results of the study revealed that 57% of the farmers had technical efficiency of 0.81 and above while 43% of the farmers operate at less than 0.81 efficiency level. The mean technical efficiency for the 100 sampled farmers in the study area was 0.78. The farmer with the best practice has a technical efficiency of 1.00 while 0.37 is for the least efficient farmers. This implies that on the average, output fall by 0% from the maximum possible level of 1.00 due to technical inefficiency. The mean allocative efficiency was 0.98. The result indicates that average yam farmer in the state would enjoy cost saving of about 5% while allocative inefficient farmer will have an efficiency gain of 95% to attain the level of most efficient farmer among the respondents. The mean economic efficiency was 0.77. The farmer with the best practice has an economic efficiency of 1.0 while 0.08 was for the least efficient farmers. This implies that on the average, output fall by 52% from the maximum possible level due to inefficiency. Finally, among the constraints identified in the study area, the majority of the respondent attested to the fact that high cost of inputs, transportation problem, lack of credit facilities and storage/preservation problem were the major constraints they faced in yam production in the area. The study concludes that yam farmers in the study area have achieved absolute efficiency in the use of variable inputs. It was found that yam production in the study area is profitable.

Keywords: Technical; Allocative; Economic; Efficiency and Data Envelop Analysis.

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1. Introduction

Agriculture, a major resource based activity in terms of capital and labor utilization has the potential of increasing Nigeria's food self-sufficiency (Bamire and Amujoyegbe, 2010). Statistical evidences however showed that food sufficiency ratio of Nigeria has for sometimes especially from (1997-2010) been less than one. Actual yield of major food crops are lower than their potential yields (Rahji, 2012). The productive yield efficiency of yam in particular was 54.1% in 1991. (Rahji, 2012)

Yam is classified under roots and tuber crops; it is the food crops that belong to genus *Dioscorea* which contains about 600 species of which only 6 are important as in the tropics. (Coursey *et al.*, 1969) economically, important cultivars are *D. rotundata* (white yam), *D. alata* (water yam), *D. bulbifera* (aerial yam), *D. dumenterum* (trifoliate yam), *D. esculenta* (chines yam) and *D. cayenensis* (yellow yam).

Although yams are grown throughout Africa, Nigeria is said to be the world's largest producer of yam, accounting for over 70-76 percent of the world total output (Onwueme *et al.*, 1978). FAO (2007) reported that Nigeria alone in 1985 produced 18.3 million tonnes of yam from 1.5 million hectares, representing 73.8 percent of 28.8 million tonnes of yam produced in Africa.

In Nigeria, yam is part of the religious heritage of several tribes and often plays a key role in religious ceremony. Worthy of note is the fact that many important cultural values are attached to yam, especially during wedding and other social ceremonies. In many farm communities in Nigeria and other West Africa countries, the size of the yam enterprise that one has is a reflection of the person's social stature. Due to the importance attached to yam many communities celebrate the new yam festival annually (Izekor and Olumese, 2012). Traditionally, yam is a prestige crop that is view and received with high respect, prominently during special gatherings such as new yam festivals in rural communities of Eastern, Central and some parts of South West of Nigeria. In the humid tropical countries of West Africa yams are one of the most highly regarded food products and are closely integrated into the social, cultural, economic and religious aspects of life. The ritual, ceremony and superstition often surrounding yam cultivation and utilization in West Africa is a strong indication of the antiquity of use of this crop. Nigeria, the world's largest yam producer, considers it to be a "man's property" and traditional ceremonies still accompany yam production indicating the high status given to the plant (FAO, 2008).

Nigeria is the largest producer of the crop, producing about 38.92 million metric tonnes annually (FAO, 2008). Yam production in Nigeria has more than tripled over the past 45 years from 6.7 million tonnes 1961 to 39.3 million in 2006 (FAO, 2007). This increase in output is attributed more to the large area planted with yam than increase in productivity (Nwosu and Okoli, 2010).

Yam is, however, one of the principal root crops in Nigeria both in terms of land under cultivation and in volume and value of production. It's one of the carbohydrate foods that are nutritionally superior to most roots and tubers in terms of digestible proteins and minerals (Calcium, Magnesium and Potassium) (Ebewore *et al.*, 2013). Tuber crops, such as yam has high relative value per unit of land used in its cultivation when compared with other crops particularly, the cereals (Mbah, 2010). As a food crop, yam has inherent characteristics. Firstly, it is rich in carbohydrates especially starch and has a multiplicity of end use. Secondly, it is more resistant to

drought, pest and disease and tolerates different climatic and edaphic conditions (Ugwumba and Omojola, 2012).

Yam is an important source of income for all value chain participants. Yam comprised 32% of farmers' gross income from crops for farmers in eastern Nigeria. The share of the value of yam farm gate sales (31%) was second only to cassava (37%) out of the nine major food crops compared in Nigeria in 2004. The higher nutritional quality and market value commanded by yam when compared with other crops like cassava, have encouraged greater investment by the Nigerian government and foreign donors to increase production and improve yam marketing efficiencies to enhance income and food security levels for smallholders. Main initiatives include: Yam Improvement for Income and Food Security in West Africa project and the National Root and Tuber Expansion Programme (Agbaje et al., 2010).

Falling yam productivity has fuelled calls for increased research activities in yam – a crop that serves as staple food to millions of people in Africa. There are great differences in yield between individual countries (FAO, 2007), but for all countries, the average yield level is far below the potential one, which has been estimated (Gurnah, 1974) at 15-20 t for dry tubers ha⁻¹ yr⁻¹ (equivalent to 60-75 t ha⁻¹ yr⁻¹ on a fresh weight basis). One major constraint highlighted for its contribution to declining yam productivity is soil fertility degradation, due to nutrient depletion by leaching, and erosion, and the loss of organic matter from most soils in Ganye Local Government Area of Adamawa state. With increasing demographic pressure, land use intensity and reduced forest cover, suitable land for yam cultivation becomes gradually scarcer (Carsky et al., 2001). In Ganye LGA, farmers practice slash-and-burn agriculture for yam production, which places great pressure on scarce virgin and fallow land resources. Natural fallow, crop rotation with grain legumes, and mineral fertilizer are the main soil fertility management strategies practiced here. However, most farmers do not use fertilizers and manures to any appreciable extent on yams.

The edible yams are root crop grown on a field scale for the tubers. They provide staple carbohydrate food in the yam zone of west Africa, where daily consumption is 0.5, 1.0kg yam need a great deal of labour for their cultivation and to prepare them for food and they are usually expensive to buy for normal human consumption, the field or peal, sometimes after partial boiling in west Africa, they are usually eaten as pounded yam which is prepared by peeling cut up yam and boil before pounding them in a wooden mortal to produce a glutinous dough (pounded yam).

Therefore, this study sought to obtain more quantitative information on technical, Allocative and economic efficiencies of yam production and to derive growth parameters that could further be used for modeling of yam growth.

1.1. Objectives of the Study

The aim of this research is to analyze the economic efficiency of yam production in Ganye local government area Adamawa State Nigeria. The specific objectives are to:

- 1) Determine the technical efficiency of yam production in the study area.
- 2) Investigate the Allocative efficiency of yam production.
- 3) Investigate the economic (overall) efficiency of yam production in the study area.
- 4) Empirically examine the determinants of efficiency of yam production

2. Literature Review

The analysis of efficiency is generally associated with the possibility of farms producing a certain optimal level of output from a given bundle of resources or a certain level of output at least cost (Amaza, 2000). Efficiency can be defined as the relative performance of the processes used in transforming input into output (Lissita and Odening, 2005). It could also be defined as the attainment of production goals without waste (Ajibefun *et al.*, 2002).

The pivotal role of efficiency in accelerating agricultural productivity and output has been applauded and investigated by numerous researchers within Africa and outside Africa alike. The decreased output of food crop production over the years may not only be connected with deviations of farmers' practices from technical recommendations but also with the use of resources at sub-optimal levels which ultimately leads to technical and economic inefficiencies (Coelli and Battese, 1996). An underlying premise behind much of the research in efficiency is that farmers are not making efficient use of existing technology, then efforts designed to improve efficiency would be more cost-effective than introducing new technologies as a means of increasing agricultural output (Belbase and Grabowski, 1985; Huynh, 2008; Adeleke, 2008).

Technical inefficiency occurs when the level of production for the firm is less than the frontier output and it arises when timing and methods of application of production inputs are mismanaged (Bakhsh, 2007).

2.1. Data Envelopment Analysis (DEA)

The data envelopment analysis (DEA) which is non-parametric has no fixed functional form and does not account for noise in the data. Thus, all deviation from the frontier will be accounted for as inefficiencies (Johansson, 2005). The measurement of efficiency is important because it leads to substantial resource savings (Bravo-Ureta and Rieger, 1991).

Data Envelopment Analysis (DEA) is a very powerful service management and benchmarking technique originally developed by Chames, Cooper and Rhodes (1978) to evaluate nonprofit and public sector organizations. Data Envelopment Analysis has since been proven to locate ways to improve service not visible with other techniques. Yet there is an anomaly surrounding this developing methodology. One of the largest US banks located over \$100 million of excess annual personnel and operating costs, enough to affect their earnings per share and these savings were not identifiable with other techniques in use. While other banks have also realized improved profits through initiatives driven by Data Envelopment Analysis, we could not locate more than 10 banks in this category. While businesses have no obligation to report their internal methods, Data Envelopment Analysis has not been widely adopted by banks. Why is DEA, a method that can generate new paths to improved profits not used when other less powerful techniques continue in use? We believe that greater adoption of DEA will only be possible when it is more accessible, a key objective of this chapter and this volume. Moreover, every service organization can benefit from DEA in different ways and DEA can be adapted to help improve service productivity. Increased use by service managers will identify new strengths and benefits that can be derived from DEA along with gaps and weaknesses. The latter can set the agenda for future research on

adapting DEA and will help identify areas where this methodology is inappropriate and ineffective, allowing managers to identify these types of applications of DEA.

Linear programming is the underlying methodology that makes DEA particularly powerful compared with alternative productivity management tools. DEA has been widely studied, used and analyzed by academics that understand linear programming. *

Managers have not widely adopted DEA to improve organization performance, in part, because most DEA publications are in academic journals or books requiring the ability to understand linear programming and supporting mathematical notation. In fact, some managers trying to use DEA based on their understanding of academic publications have misunderstood the way to apply DEA. They erroneously attribute weak results to the technique when the problem is often due to the misapplication of DEA.

This literature explains what DEA does, how DEA evaluates efficiency, how DEA identifies paths to improve efficiency, limitations of DEA, and how to use DEA. This will enable managers to explore and assess the value of using DEA in their service operations. Sherman and Zhu (2006)

2.2. Advantages of Data Envelopment Analysis

- 1) DEA can effectively handle and accommodate multiple inputs and multiple outputs models without any hitches.
- 2) There is actually no specification of functional forms in DEA and neither does it require an assumption of a functional form linking outputs and inputs to outputs.
- 3) In DEA, the decision making units (DMUs) are compared directly against a peer or combination of peers.
- 4) With regards to measurement units, all the Inputs and outputs can have very varying units under DEA approach. For instance, P1 could be in units of kilogram weight (Kg) and P2 could be in units of ringgit (MYR) without requiring a priori trade-off between the two units.

2.3. Disadvantages of Data Envelopment Analysis

- 1) Being an extreme point approach, DEA has no provision or accommodation for noise. In fact noise is part and parcel of efficiency scores. Thus, is a problem because noise such as measurement error can cause significant problems in the estimation.
- 2) Although DEA has good reputation in estimating relative efficiency of DMUs, however, its gradually converges to absolute efficiency. Putting it in a different way, DEA helps to indicate how a DMU is compared to its peer, but hardly tell how well a DMU is when compared to a “theoretical maximum”
- 3) Being a non-parametric method, it’s rather very difficult to conduct hypothesis test smoothly in DEA. However, this hurdle has gradually been eliminated through bootstrapping technique.
- 4) Large problems might be computationally cumbersome and intensive, since each Decision making units has a separate linear program created DEA.

3. Methodology

3.1. The Study Area

This study was conducted in Ganye LGA of Adamawa State, Nigeria. The area is located in the Southern part of the State between latitude $8^{\circ} 45' 1''$ and $8^{\circ} 26' 1''$ E, and longitude $12^{\circ} 09' 1''$ and $12^{\circ} 03' 1''$ N. It has land mass of 14,561,120 km². The area is bounded in the South East by Cameroun Republic, South by Toungo Local Government Area, North by Jada Local Government Area and in the West by Taraba State. The climate of the area is the tropical South-Humid type with marked dry and rainy seasons. Rainy season commences in April with highest rainfall mostly being recorded in September. The area has a good rainfall pattern with some areas having as high as 1,400mm (Adebayo, 1999). And moderately hot temperature estimated at 28°C which is normally being experienced between March and April.

The area is well noted for its agricultural potentiality which earned it the name food basket of Adamawa State due to the varieties of food and cash crops being cultivated and marketed in the area. Yam is one of the major cash crops that the area produced. The area is located within the Guinea Savannah vegetation belt, and has rich agricultural land suitable for growing all types of crops, vegetables, fruits, cereals, cash crop such as sugarcane, cashew among others. Domestic animals such as cattle, goat, and sheep are also being reared to supplement the farmers/marketers income. It was estimated that about 300,000 heads of cattle and 400,000 sheep and goats are being reared as either solitary or through mixed farming (Adebayo, 1999).

3.2. Sampling Procedure

The simple random sampling was used in choosing the sample for the investigation. In the first place five wards were used for this study namely Gurum, Timdore, Gamu, Sugu and gantum. Twenty farmers were selected from each ward. 100 questionnaires were issued to the farmers, twenty questionnaires were allocated to each ward.

3.3. Method of Data Collection

The researcher made use of questionnaire to collect information or data, the questionnaire consist of 27 items divided into four sections (A,B,C and D). Section A consisted of the farmers' demographic information while section B and C contains the input and output data and D contains the constraints obtained from the respondent, using structured questionnaires designed in English and orally to the farmers in their local language (Hausa). The questionnaires sought the input-output data of the farmers for both the production and cost function analyses.

3.4. Analytical Techniques

3.4.1. Variable Returns to Scale (VRS) Model

The restriction of production set placed by Charnes, Cooper and Rhodes (CCR) model in its assumption of constant return to scale (CRS) has since been replaced and relaxed the restriction by the addition of a convexity restriction by Banker, Charnes and Cooper (BCC) know as BCC

model. The Model has DMU assumed to Variable Return to Scale (VRS) with convexity restriction($\sum_{j=1}^n \lambda_j = 1$). The BCC model is expressed below.

$$\begin{aligned}
 \text{Min} \quad & \theta - \varepsilon \sum_{r=1}^s S_r^+ + \sum_{r=1}^m S_i^- \\
 \text{s.t} \quad & \sum_{j=1}^n \lambda_j X_{ij} + S_i^- \leq \theta X_{ij} \\
 & \sum_{j=1}^n \lambda_j Y_{rj} - S_r^+ \geq Y_{rj} \\
 & \sum_{j=1}^n \lambda_j = 1 \\
 & \lambda_j, S_r^+, S_i^- \geq 0; \forall i, r, j; r = 1, 2, \dots, s; i = 1, 2, \dots, n
 \end{aligned}$$

3.4.2. Technical Inefficiency

Below is the truncated –normal distribution of the Technical inefficiency effects(u_i)

$$\begin{aligned}
 (u_i) = E(u_i | \varepsilon_i) &= \frac{\sigma \lambda}{(1 + \lambda^2)} \left[\frac{\phi\left(\frac{\varepsilon_i \lambda}{\sigma}\right)}{\Phi\left(-\frac{\varepsilon_i \lambda}{\sigma}\right)} - \left(\frac{\varepsilon_i \lambda}{\sigma} + \frac{\mu_i}{\sigma \lambda}\right) \right] \\
 \sigma &= (\sigma_u^2 + \sigma_v^2)^{1/2}, \lambda = \sigma_u / \sigma_v, \mu = -\varepsilon_i \sigma_u^2 / \sigma^2
 \end{aligned}$$

3.4.3. Tobit Regression Model

Tobit Regression Model was used to determine the factors influencing technical, allocative and economic efficiencies of yam production achieve specific objective v.

$$\text{EFF}_{ij} = \alpha_0 + \alpha_1 x_{ij1} + \alpha_2 x_{ij2} + \alpha_3 x_{ij3} + \alpha_4 x_{ij4} + \alpha_5 x_{ij5} + \alpha_6 x_{ij6} + \alpha_7 x_{ij7} + \alpha_8 x_{ij8} + \varepsilon_{ij}$$

Where:

- EFF = efficiency index for ith farmer (That is efficiencies scores)
- α_0 = intercept coefficient
- $\alpha_1 - \alpha_{16}$ = parameters estimated
- Socioeconomic Factors:
- X_1 = Gender
- X_2 = Marital Status
- X_3 = Experience
- X_4 = Education level
- X_5 = Family size
- X_6 = Occupation
- X_7 = Farm size
- X_8 = Farmers’ Age

4. Results and Discussion

4.1. Results of Technical Efficiency of Yam Farmers in the Study Area

The frequency distribution of the technical efficiency estimates for cowpea farmers in the study area as obtained from the stochastic frontier model is presented in Table 17. The study revealed that 57% of the yam farmers had technical efficiency (TE) of 0.81 and above while 43% of the farmers operate at less than 0.81 efficiency level. The yam farmers with the best and least practices had technical efficiencies of 1.00 and 0.37 respectively. This implies that on the average, yam output fall by 0% from the maximum possible level of 1.00 due to technical inefficiencies. The result also showed a mean technical efficiency of 0.78. This means that majority of the yam farmers operated closer to their production frontier. Also, this implies that on the average, yam farmers are able to obtain 78% potential output from a given mix of productive resources. In a short-run, there is scope for increasing yam output by 22% by adopting the techniques and technologies employed by the best yam farmers. Furthermore, the study also revealed that for the average yam farmer in the study areas to become the most efficient yam farmer, he will need to realize about 22% cost savings, while on the other hand, the least technically efficient yam farmer will need about 78% cost savings to become the most technically efficient yam farmer. This finding is in line with Okoye, *et al.* (2010) who observed that average cocoyam farmer in the state would enjoy cost saving of about 32.9% (1-0.65/0.97) if he or she attains the level of the most efficient producer among cocoyam producers in the study area.

Table 1: Technical Efficiency of Yam Farmers in the Study Area

T.E Range	Frequency	Per cent (%)
0.00-0.10	0.00	0.00
0.11-0.20	0.00	0.00
0.21-0.30	0.00	0.00
0.31-0.40	1.00	1.00
0.41-0.50	3.00	3.00
0.51-0.60	15.00	15.00
0.61-0.70	18.00	18.00
0.71-0.80	6.00	6.00
0.81-0.90	34.00	34.00
0.91-1.00	23.00	23.00
Total	100.00	100.00
Summary Statistics Mean	0.78	
Median	0.81	
Mode	1.00	
Standard Deviation	0.17	
Minimum	0.37	
Maximum	1.00	

Source: Field survey (2017)

Note:

Fully efficient: 1.000

Absolute inefficiency: 0.000

Varying degree of inefficiency: between 0.000 and 1.000

4.2. Frequency Distribution of Allocative Efficiency of Yam Farmers

Table 2 below depicts the frequency distribution of the allocative efficiency estimates of yam farmers in the study areas. The result revealed that 95% of the yam farmers had allocative efficiency (AE) of 0.91 and above while 5% of the farmers operate at less than 0.90 allocative efficiency levels. This implies that only few of the yam farmers were not allocative efficient as 95% of them attained efficiency level greater than 0.91 and above. In other words, the clustering of allocative efficiencies in the region of 0.91 – 1.00 efficiency range implies that the yam farmers are efficient. That is, the farmers are efficient in producing yam at a given level of output using the cost minimizing input ratio as about 95% of the yam farmers have allocative efficiencies of 0.91 and above. High values of allocative efficiencies represent less efficiency or more inefficiency among the yam farmers during the course of yam production in the study areas. The estimated allocative efficiencies differ substantially among the yam farmers ranging between the minimum value of 0.22 and maximum value of 1.00. This means that the most allocative inefficient yam farmers operated closer to their cost frontier or minimum cost of 1.00. The mean allocative efficiency was 0.98. The study also revealed that for the average yam farmer in the study areas to become the most Allocative efficient yam farmer, he will need to realize about 5% cost saving, while on the other hand, the least technically efficient yam farmer will need about 95% cost savings to become the most Allocative efficient yam farmer.

Table 2: Allocative Efficiency of Yam Farmers in the Study Area

A.E Range	Frequency	Per cent (%)
0.00-0.10	0.00	0.00
0.11-0.20	0.00	0.00
0.21-0.30	1.00	1.00
0.31-0.40	0.00	0.00
0.41-0.50	0.00	0.00
0.51-0.60	1.00	1.00
0.61-0.70	0.00	0.00
0.71-0.80	2.00	2.00
0.81-0.90	1.00	1.00
0.91-1.00	95.00	95.00
Total	100.00	100.00
Summary Statistics Mean	0.98	
Median	1.00	
Mode	1.00	
Standard Deviation	0.10	
Minimum	0.22	
Maximum	1.00	

Source: Field survey (2017)

Note:

Fully efficient: 1.000

Absolute inefficiency: 0.000

Varying degree of inefficiency: between 0.000 and 1.000

4.3. Economic Efficiency of Yam Farmers in the Study Area

The frequency distribution of the economic efficiency estimates of yam farmers in the study areas is contained in Table 3. The result revealed that 48% of the yam farmers had economic efficiency (EE) of 0.81 and above while the remaining 52% of the yam farmers operated at less than 0.81 efficiency level. The mean economic efficiency of the yam farmers in the study areas was 0.77. This implies that on the average, there was an efficient economic output level by 52% from the maximum feasible level due to economic inefficiency. The yam farmer with the best and least practice had economic efficiencies of 1.00 and 0.08 respectively. In the same vein, the study also revealed that for the average yam farmer in the study area to achieve economic efficiency of his most efficient counterpart, he will have to realize about 52% cost savings while on the other hand, the least economic efficient yam farmers will have to realize about 48% cost savings to become the most economic efficient yam farmer. However, the result indicates that the highest number of yam farmers have economic efficiencies between 0.81-0.90, representing about 25% of the 100 yam farmers. This is an indication that the yam farmers were not economic efficient in producing yam at a minimum cost for a given level of technology

Table 3: Economic Efficiency of Yam Farmers in the Study Area

E.E Range	Frequency	Per cent (%)
0.00-0.10	1	1
0.11-0.20	0	0
0.21-0.30	1	1
0.31-0.40	2	2
0.41-0.50	3	3
0.51-0.60	12	12
0.61-0.70	19	19
0.71-0.80	14	14
0.81-0.90	25	25
0.91-1.00	23	23
Total	100	100
Mean	0.77	
Median	0.8	
Mode	1	
SD	0.19	
Min	0.08	
Max	1	

Source: Field survey (2017)

Note:

Fully efficient: 1.000

Absolute inefficiency: 0.000

Varying degree of inefficiency: between 0.000 and 1.000

Table 4: Tobit Regression Estimates for the Technical, Allocative and Economics Inefficiencies of Yam Farmers.

Technical efficiency			Allocative efficiency		Economic efficiency	
Variables	Coefficient	T-ratio	Coefficient	T-ratio	Coefficient	T-ratio
Constant	(0.63) ***	5.10	(0.92) ***	13.58	(0.59)***	4.29
Gender	(-0.07)	-1.63	(-0.07)***	-3.00	(-0.10)***	-2.03
Marital status	(0.07) ***	2.48	(0.03)**	1.62	(0.08)***	2.54
Age	(0.00)	0.06	(0.00)	0.11	(0.00)	0.09
Occupation	(0.06)**	1.76	(0.06)***	3.01	(0.08)***	2.19
H/size	(0.00)	-0.27	(-0.01)*	-1.42	(-0.01)	-0.55
Edu-status	(0.00)	-0.12	(-0.01)	-0.52	(-0.01)	-0.24
years of experience	(0.00)	-0.18	(0.00)	0.22	(0.00)	-0.11
Farm size	(0.00)	-0.03	(0.01)	0.78	(0.00)	0.14

5. Conclusion and Recommendations

This study focused on the economics efficiency of yam production in Ganye Local Government Area of Adamawa State, Nigeria. A combination of purposive and random selection of five wards from the LGA and 100 farmers were selected from this area and to achieve this, the specific objectives were to: Determine the farmers' socio-economic characteristics in the study area, estimate the economic (overall) efficiency of yam production in the study area, determine the technical efficiency of yam production in the study area, investigate the allocative efficiency of yam production and empirically examine the determinant of efficiency of yam production.

The simple random sampling was used in choosing the sample for the investigation. In the first place five wards were used for this study namely Gurum, Timdore, Gamu, Sugu and gantum. Twenty farmers were selected from each ward. 100 questionnaires was issued to the famers, twenty questionnaires were allocated to each ward. The analytical tools used to achieve the objectives of this study were descriptive statistics and Data Envelopment Analysis.

A descriptive analysis of the sample farmers was done to understand and describe the socio-economic factors influencing yam production and as well as income made from the production in the study area. It was observed from the study that 57% of the farmers had technical efficiency (TE) (0.81) and above while 43% of the farmers operate at less than 0.81 efficiency level. The mean technical efficiency for the 100 sampled farmers in the study area was 0.78. The farmer with the best practice has a technical efficiency of 1.00 while 0.37 is for the least efficient farmers. This implies that on the average, output fall by 0% from the maximum possible level of 1.00 due to technical inefficiency. The mean allocative efficiency was 0.98. The result indicates that average yam farmer in the state would enjoy cost saving of about 5% while allocative inefficient farmer will have an efficiency gain of 95% to attain the level of most efficient farmer among the respondents. The mean economic efficiency was 0.77. The farmer with the best practice has an economic efficiency of 1.0 while 0.08 was for the least efficient farmers. This implies that on the average, output fall by 52% from the maximum possible level due to inefficiency.

Finally, among the constraints identified in the study area, the majority of the respondent attested to the fact that high cost of inputs, transportation problem, lack of credit facilities and storage/preservation problem were the major constraints they faced in yam production in the area.

5.1. Recommendations

- 1) Fertilizer and labour source are some of the inputs that positively and significantly influence yam production in the study area. Therefore, government should ensure timely and adequate supply of fertilizer to farmers through its GESS (Growth Enhancement Support Scheme) programme at affordable prices in order to enhance the production of this crop.
- 2) Most of the respondents complained of high cost of farm input Such as fertilizers, improved seeds. And also transportation, credit facilities and storage/preservation as part of the constraints they faced. The cooperative societies will link-up the farmers with sources of input. This will enable the groups to buy inputs at factory price thereby helping to minimize cost of production.
- 3) The positive relationship between amount of credit accessed and efficiency of the farmers implies that policies that will make micro-credit from government and non-governmental agencies accessible to these farmers will go a long way in addressing their resource use inefficiency problems.
- 4) Government in partnership with private sector should encourage farmers to increase their technical efficiency in yam production which could be achieved through improved farmer specific efficiency factors, which include improved farmer education, access to credit, access to improved extension services.

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