ANALYSIS OF ALLOCATIVE EFFICIENCY AMONG SMALL-SCALE TUBER CROP FARMERS IN NORTH-CENTRAL, NIGERIA

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ABSTRACT

The empirical study examined the allocative efficiency of small holder tuber crop farmers in North central, Nigeria. Data used for the study were obtained from primary source using a multi-stage sampling technique with structured questionnaires administered to 300 randomly selected tuber crop farmers from the study area. Descriptive statistics, data envelopment analysis and Tobit regression model were used to analyze the data. The DEA result on the classification of the farmers into efficient and inefficient farmers showed that 17.67% of the sampled tuber crop farmers in the study area were operating at frontier and optimum level of production with mean allocative efficiency of 1.00. This shows that 82.33% of the farmers in the study area can still improve on their level of efficiency through better utilization of available resources, given the current state of technology. The results on effects of the significant determinants of allocative inefficiency at various distribution levels revealed that allocative efficiency increased from 22% to 34% as the farmer acquired more farming experience. The allocative efficiency index of farmers that belonged to cooperative society was 0.23 while their counterparts without cooperative society had index value of 0.21. The result also showed that allocative efficiency increased from 0.43 as farmer acquired high formal education and decreased to 0.16 with farmers with non-formal education. The efficiency level in the allocation of resources increased with more contact with extension services as the allocative efficeincy index increased from 0.16 to 0.31 with frequency of extension contact increasing from zero contact to maximum of twenty contacts per annum. The results further show that the age of the farmers had 32% input to the efficiency but reduces to an average of 15%, as the farmer grows old. It is therefore recommended that enhanced research, extension delivery and farm advisory services should be put in place for farmers who did not attain optimum frontier level to learn how to attain the remaining 74.39% level of allocative efficiency through a better production practices from the robustly efficient farms. This will go a long way to increase the efficiency level of the farmers in the study area.

Keywords: Allocative efficiency, DEA, tuber crop

INTRODUCTION

Nigeria has a total land area of about 98.3 million hectares out of which only 71.2 million hectares are cultivable, while 34.2 million hectares (about 48% of the cultivable area) are actually being cultivated and less than 10% of the arable land is irrigated (Daramola, 2004). The agricultural sector has always been an important component of the Nigerian economy. The sector is almost entirely dominated by small-scale resource poor farmers living in the rural areas, with farm holdings of 1 to 2 hectares, which are usually scattered over a wide area (Alimi, 2012). The role of agriculture remains significant in the Nigerian economy despite the strategic importance of the oil sector. Hence, there is need to structure the agricultural sector in order to enhance its traditional roles of supplying raw materials for the growing industries generating non-oil foreign exchange earnings, as well as providing employment and food for the growing population (Union Digest, 1999). According to Food and Agriculture Organization (FAO), (1990), the difficulties faced by many developing countries satisfying their population's requirements with domestic food production have increased. As a result, widespread food shortages, hunger and malnutrition have persisted, particularly among the low-income groups in developing countries. More recently, priority has been given to production and consumption of tuber crops in view of their important role in improving food security. International Food Policy Research Institute (IFPRI) (2010) reported that cereals, roots, and tubers dominated Nigerian crop production, and Nigeria is the world's leading producer of cassava, yams and cowpea. According to FAOSTAT, (2012) , Nigeria is the largest producer of tuber crop (cassava and yam) in the world putting cassava and yam production at 43.4 and 29.2 million tonnes a year respectively. Despite this high level of tuber crop production in Nigeria, the expected increase in the demand for tuber crops occasioned by population growth and declining per-capita incomes will require continued increase in tuber crop farms productivity. Most research findings had shown that tuber crop farmers in Nigeria are not operating at frontier efficiency level which implies that tuber crop farmers can still improve on their level of efficiency through better utilization of available resources, given the current state of technology (Ogundari and Ojo, 2006, 2007; Fasasi, 2007; Awoniyi and Omonona, 2007; Fakayode *et al.*, 2008 Ojo *et al.*, 2009). Hence, the role of increased efficiency and productivity of tuber farms is no longer debatable but a great necessity in order to increase the efficiency of small holder farms in Nigeria, since tuber crops have the potential for bridging the food gap. It is to this end that this study was undertaken with the view to analyze the allocative efficiency of tuber crop farmers in North central, Nigeria.

Theoretical Framework

Efficiency according to Pascoe and Mardle (2003), measures the ability of firms to produce the maximum output possible from a given set of inputs. It reflects the difference between actual and potential performance of the firm. Hence, the better the utilization of inputs in the production of output, the better the efficiency. Three types of efficiency have been identified; technical, allocative and economic efficiencies (Farell, 1957; Okpe *et al.*, 2012; Watkins *et al.*, 2014). Technical efficiency (TE) measures the ability of a firm to produce the maximum feasible output from a given level of inputs under a given technology. Chavas and Aliber (1993), defined technical efficiency as the minimal proportion by which a vector of inputs x can be rescaled while still producing output y and it is represented as follows;

$$TE(y, x, T_v) = inf_k\{k: (y, -kx) \in T_v, k \in \Re^+\} \quad (1)$$

In principle, $0<TE\leq1$, where TE=1 implying that the firm is producing on the production frontier and is technically efficient. On the other hand, TE<1 implies that the firm is not technically efficient.

Allocative efficiency (AE) also referred to as price efficiency considers the relative prices of inputs while measuring the degree of success of the firm to achieve the best combination of different inputs in producing specific quantity of output. It reflects the ability of a technically efficient firm to utilize its inputs in a cost minimizing way. Allocative efficiency index is represented as;

$$AE(r, y, T_v) = C(r, y, T_v/[r^{\iota}(TE)x] \quad (2)$$

Where; $C(r, y, T_v$ is the cost function under technology T_v and [(TE)x] is a technically efficient input vector from equation 1. Generally, 0<AE≤1 indicates a cost minimizing behaviour where AE=1 implies the firm is allocatively efficient and AE<1 implies allocatively inefficient. Economic efficiency (cost efficiency) is the product of both AE and TE, thus a firm that is both technically and allocatively efficient will be said to be efficient economically.

Two approaches can be used to estimate efficiency; the Stochastic Production Frontier (SPF) which is a parametric method and the Data Envelopment Analysis (DEA) a non-parametric approach (Coelli, 1995; Watkins *et al.*, 2014). While the SPF includes component that account for statistical noise due to data measurement error and a non-negative component that measures inefficiency, the DEA attributes all deviations from the frontier to inefficiency. The TE for a field can be obtained using DEA model specification by solving the following linear programming (LP) problem as stated by Watkins (2014);

$$TE_n = \min_{\lambda_i \theta_n} \theta_n \quad (3)$$

Subject to;

$$\sum_{i=1}^{I} \lambda_i x_{ij} - \theta_n x_{nj} \leq 0$$

$$\sum_{i-1}^{I} \lambda_i y_{ik} - y_{nk} \geq 0$$

$$\sum_{i=1}^{I} \lambda_i = 1$$

$$\lambda_i \geq 0$$

Where; i= one to I fields; j= one to J inputs; k= one to K outputs; λ_i= the non-negative weight for I fields; x_{ij}= the amount of input j used on field I; x_{nj} = the amount of input j used on field n; y_{ik}= the amount of output k produced on field I; y_{nk}= the amount of output k produced on field n and θ_n= a scalar less or equal to one and it defines the TE of field n.

When θ_n= 1, it indicates that field n is technically efficient. However, a value less than 1 indicates that field n is technically inefficient. The inclusion of $\sum_{i=1}^{I} \lambda_i = 1$ in equation 3 implies that TE for field n is calculated under variable returns to scale implying an assumption that input overuse is the same for all technically inefficient fields. The economic efficiency score for a given field n is calculated by solving the following cost minimization problem.

$$MC_n = min_{\lambda_i x_{nj}^*} \sum_{j=1}^{J} P_{nj} \, x_{nj}^* \quad (4)$$

Subject to;

$\sum_{i=1}^{j} \lambda_i x_{ij} - x_{nj}^{*} \leq 0$

$\sum_{i-1}^{I} \lambda_i y_{ik} - y_{nk} \geq 0$

$\sum_{i=1}^{I} \lambda_i = 1$

$\lambda_i \geq 0$

Where; MC_n= the minimum total cost for field n; P_{nj}= the price for input j on field n and x_{nj}^{*}= the cost minimizing level of input j on field n given its input price and out levels. Other variables are as defined in equation 3.

The economic efficiency for each field n can further be calculated as follows;

$$EE_n = \frac{\sum_{j=1}^{J} P_{nj} x_{nj}^{*}}{\sum_{j=1}^{J} P_{nj} x_{nj}} \quad (5)$$

Where; $\sum_{j=1}^{J} P_{nj}\, x_{nj}^{*}$ is the minimum total cost obtained for field n using equation 4 and $\sum_{j=1}^{J} P_{nj} x_{nj}$ is the actual total cost obtained for field n.. When EE_n= 1 it implies field n is economically efficient but a value less than 1 implies otherwise.

Allocative efficiency can be measured once the TE and EE have been calculated since EE is the product of TE and AE. Therefore;

$$AE_n = \frac{EE_n}{TE_n} \quad (6)$$

The interpretation of AE_n is same as that of EE_n and TE_n in equations 3 and 5 above.

METHODOLOGY

Study Area*:* This study was conducted in the North Central Nigeria. The zone comprises of Benue, Kogi, Kwara, Niger, Nasarawa and Plateau States, including the Federal Capital Territory (FCT), Abuja. The zone occupies a total land area of 296,898 km^2 representing about 32% of the land area of the country. It is located between latitude 6^o 30’ to 11^o 20’ North and longitude 2^o 30’ to 10^o 30’ East (Shuaib *et al*, 1997). More than 77% of the people in the region are rural dwellers and are mostly engaged in one form of agricultural activities or the other (Shuaib *et al*, 1997). According to Tologbonse (2004), the zone has two main seasons’ namely dry and wet seasons, with the wet season beginning towards the end of the March and end at the end of October, while the dry season is from November to March. The rainfall per annual ranges from 1000 to 1500mm with the average of 187 to 220 rainy days with average monthly temperature ranges from 21^oC and 37^oC.

The vegetation of the zone consists of the forest Savannah Mosaic, Southern Guinea Savannah and the Northern Guinea Savannah. Geographically the zone is characterized by varying landforms such as extensive and swampy feature which are common in the lowland areas which occur in the areas along the valleys of Niger and Benue rivers, deep valleys large hills, mountains and plateaus. The vegetation, soil and weather patterns are favorable for the production of a wide spectrum of agricultural food, industrial and cash crops of various types. The major crops grown in the North Central Nigeria include rice, maize, millet sorghum, yam and cassava.

Sampling technique and sample size

Primary data were collected using multi-stage sampling technique. The first stage involved purposive selection of Niger and Kogi States in the North Central Zone because of the prevalence of root and tuber crops production in these study areas. Cassava and yam were purposely selected for this research work because they are the prevalent tuber crops produced in these study areas as confirmed by IITA, (2004). On a *per capita* basis, North-Central is the highest cassava and yam producing zone at 0.72 and 0.57 tonnes per farmer respectively in 2002 and National *per capita* production of cassava is 0.32 tonne per person with Benue and Kogi States in the North Central Zone as the largest producers of cassava. This was followed by random selection of 3 Local Government Areas (LGAs) in each State making 6 LGAs altogether. The LGAs selected in Niger State are Shiroro, Lapai and Gurara while Mopamuro, Kabba/Bunu and Ijumu LGAs were selected in Kogi State.The third stage involved a simple random selection of five villages in each LGA and ten yam and cassava farmers in each village to give a total of 300 sampled farmers as respondents for this study.

Method of data collection

A limited cost-route approach method was used in data collection for this study. The data were collected with the use of structured questionnaire designed in line with the objectives of the study. Data collected included total output produced per annum in tonnes, while the inputs included the size of farm land in hectare, quantity of seeds as planting materials in kg; quantity of fertilizer used in kg; quantity of herbicides used in litres and total labour in man-days which include family and hired labour utilised for planting operations and harvesting; prices of yam and cassava in naira; total production cost per year; average wage rate per man days of labour, price per kg of planting materials, average price of agrochemicals, fertilizer and farm tools. Also, data collected include the farmer's socio-economic variables such as farmer's age, years of schooling, household size, number of contact with extension agents and accessibility to credit.

Empirical Model specification

The non-parametric analysis (DEA) was used to estimate the allocative efficiency of the root crop farmers in the study area. The output variable used for estimating allocative efficiency was total farm output (tons) (Y). Total farm output included outputs of yam and cassava in tons which were aggregated using wheat grain equivalent table. The inputs used included farm size (ha), labour (man-day), planting materials (kg), agrochemical (herbicides and pesticides) and fertilizer (kg) . Tobit regression analysis was further applied to determine the factors affecting the allocative inefficiency of the farmers. In the Tobit analysis, the efficiency scores (the ratio of actual to the potential output level (Y*/Yi)) of the most inefficient farms in the system are found closer to zero (Y*/Yi>0). Therefore, while the scores are bounded between zero and unity with the upper limit set at one, the distribution is censored at both tails (0 <Y*/Yi ≤1).

The Tobit regression is expressed as follows:

$$\mu = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_5 Z_{5i} + \delta_6 Z_{6i} + \delta_7 Z_{7i} + \delta_8 Z_{8i} + \delta_9 Z_{9i} + \delta_{10} Z_{10i} \text{ .... (7)}$$

Where:

μ = Allocative inefficiency (This was obtained as specified in equation 6)

Z_1 = Farmer's sex (1, if male; 0, if female)

Z_2 = Years of experience in the chosen enterprise

Z_3 = Level of involvement in farming (0, if part-time; 1, if full-time)

Z_4 = Household size (number of people available for farm work)

Z_5 = Membership of cooperative society (1 if respondent is a member of yam or cassava cooperative society; 0 otherwise)

Z_6 = Education (years)

Z_7 = Age (year)

Z_8 = Extension contact (number of contact with extension agent in the production season)

Z_9 = Credit usage (1, if credit is taken for farming; 0, if not)

Z_{10} = Farm size allocated to cassava and yam production (hectare)

δs = unknown scalar parameters to be estimated

RESULTS AND DISCUSSION

Production analysis: The summary statistics of the variables for the data envelopment analysis (DEA) for tuber crop production in North-central, Nigeria is presented in Table 1. The results from Table 1 shows that the mean of 2.79 tons of outputs per annum was obtained from the data analysis with a standard deviation of 2.72 in the study area. Analysis of the inputs also revealed an average farm size of 2.63ha per farmer, an indication that the study covered small-scale farm units. The average labour of 138.31 man- days show that tuber farmers in the study area relied heavily on human labour to do most of the farming operations. The analysis of other input variables showed the mean values of 217.32kg, ₦7,440.13 and 1338.94kg for fertilizer, cost of agrochemical and planting materials respectively. All these findings point to the characteristic nature of subsistence farming which dominates agricultural production in Nigeria.

Variables representing the demographic characteristics of the sampled farmers employed in the analysis of the determinant of allocative efficiency include years of experience, household size, age of the farmers, educational level of the farmers and number of extension contacts. The average years of experience, household size, age of the farmers, year of schooling, and number of extension contacts were 24.29, 6.88, 40.82, 9.55 and 1.37 respectively, meaning that the farmers were relatively young and with no formal education.

Table 1: Summary statistics of the variables in data envelopment analysis for tuber crop production in North Central, Nigeria.

Variables	Mean	Standard Deviation	Minimum	Maximum
Total Output (ton)	2.79	2.72	0.05	25.60
Total farm size (ha)	2.63	1.74	0.50	10.00
Labour (manday)	138.31	56.28	12.00	230.00
Total Planting Material (kg)	1338.94	2731.35	0.90	24200.00
Agrochemical (₦)	7440.13	8893.97	250.00	54000.00
Total Fertilizer(kg)	217.32	123.43	0.50	1000.00
Experience(years)	24.29	11.55	0.00	60.00
Household size	6.88	4.31	1.00	20.00
Age (yr)	40.82	11.14	20.00	75.00
Education (years)	9.55	4.76	0.00	19.00
Extension contact	1.37	1.65	0.00	6.00

Source: Field Survey, 2013

The summary DEA results on the classification of the farmers into efficient and inefficient farmers are shown in Table 2. The result shows that only 17.67% of tuber crop farmers in study area operated at frontier and optimum level of production with mean allocative efficiency 0.2561. This shows that 82.33% of the tuber crop farmers in the study area can still improve on their level of efficiency through better utilization of available resources, given the current state of technology.

Table2: Summary of Results of the DEA Model Showing Efficient and Inefficient Farms in the Study Area

Farms	Frequency	Percentage	Mean Technical Efficiency
Number of inefficient farms	247	82.33	0.2486
Number of efficient farms	53	17.67	1.0000
Sample (Number of farms)	300	100.00	0.2561

Source: Field Survey, 2013

The indices in Table 3 shows that the mean allocative efficiency of the sampled tuber crop farmers in the study area was less than one (less than 100%), implying that averagely the farmers in the study area were producing below the maximum efficiency frontier. Some farmers demonstrated a range of technical efficiency of 1.00 (100%) while the worst farmer had an allocative efficiency of 0.013 (1.3%). The mean technical efficiency is 0.2561 (25.61%), implying that the tuber crop farmers still have room to increase the efficiency in their farming activities as 74.39 percent efficiency gap from optimum (100%) was yet to be attained by all farmers. Thus, in short run there is a scope for increasing tuber crop yield by 74% by adopting the technology and techniques used by best practice tuber crop farms in the study area.

Table 3: Frequency Distributions of Allocative Efficiency Scores Obtained with DEA Model for Tuber Crop Farm in the Study Area

Allocative Efficiency	Frequency	Percentage
0.01 - 0.10	41	13.67
0.11 - 0.20	72	24.00
0.21 - 0.30	44	14.67
0.31 - 0.40	32	10.67
0.41 - 0.50	19	6.33
0.51 - 0.60	23	7.67
0.61 - 0.70	14	4.67
0.71 - 0.80	1	0.33
0.81 - 0.90	1	0.33
0.91 - 1.00	53	17.67
Mean	0.2561	
Standard Deviation	0.1937	
Minimum	0.013	
Maximum	1	

Source: Field Survey, 2013

Table4: Results of Tobit model for factors influencing allocative inefficiency in the study area

Variables	Coefficients	t value
Sex	0.0386	1.21
Farming experience (year)	-0.0037	-3.08***
Farm involvement level	0.0352	1.23
Household size	0.0008	0.29
Cooperative membership	-0.0797	-2.90***
Education (year)	-0.0003	-2.65***
Age (year)	0.0017	2.53**
Extension contact	-0.0001	-2.02**
Credit access	-0.0073	-2.23**
Farm size (ha)	-0.018	-2.66***

Number of observation = 300
F-value = 4.88
Prob > F = 0.0000
Pseudo R^2 = 0.4607
**** = Significant at 1% level of probability,*
*** = Significant at 10% level of probability*
Source: Field Survey, 2013

Table 4 shows the result for the regression analysis of the factors influencing allocative inefficiency in small scale tuber crop production in North Central, Nigeria. The estimated coefficients of the inefficiency function provide some explanations for the relative efficiency levels among individuals' farms. Since the dependent variable of the inefficiency function represents the mode of inefficiency, a positive sign of an estimated parameter implies that the associated variable has a negative effect on efficiency and a negative sign indicates the reverse. The F- value of 4.88 in the regression results indicates that all the variables included in the model jointly and significantly explain variation in the inefficiency of the tuber farmers in the study area at 1% probability level. The negative coefficients for farming experience, education, cooperative society membership, extension contacts, credit access and farm size imply that as the year of farming experience, level of education, cooperative society membership, extension contacts, credit access and farm size increased in the study area, the allocative inefficiency of the farmers decreased. This finding is in conformity with the work of Ogundari and Ojo, (2001), who reported that farmer's inefficiency decreased with increase in educational level and credit availability. Education enhances the acquisition and utilization of information on improved technology by the farmers as well as their innovativeness (Effiong, 2005 and Onyenweaku *et al.*, 2005). Also farmers' access to credit enhances their timely acquisition of production inputs that would enhance productivity via efficiency (Idiong, 2007). The farmers' membership of cooperative society positive relationship with efficiency implies that making and implementing of policies that would encourage farmers to form cooperatives/farmers organization or join existing ones will be a step in the right direction. The estimated coefficient for farm size is negative, which conforms to *a priori* expectations, indicating that the level of allocative inefficiency of the small holder croppers tend to reduce with increase in farm size. This finding also conforms with (Fasasi, 2007). Also, positive coefficient for age implied that the farmers' level of allocative inefficiency increased with increased in age. This agrees with the findings of Oladeebo and Fajuyigbe, (2007) who reported that the younger farmers are more efficient in food crop production than the older farmers. Older farmers tend to be more conservative and less receptive to modern and newly introduced agricultural technology.

The effects of the significant determinants of allocative inefficiency at various distribution levels is shown in Table 5. The results in the table show that allocative efficiency increased from 22% to 34% as the farmer acquired more farming experience. This confirms that increase in years of farming experience leads to increases efficiency. The allocative efficiency index of farmers that belonged to cooperative society was 0.23 while their counterparts without cooperative society had index value of 0.21. This implies that belonging to cooperative society had a positive effect on the efficient allocation of resources in the study area. The result also shows that allocative efficiency increased from 0.43 as farmer acquired high formal education and decreased to 0.16 with farmers with non-formal education. This confirms that access to formal education increases efficiency.The results further show that the age of the farmers has 32% input to the efficiency but reduces to an average of 15%, as the farmer grows old. This confirms the findings that efficiency of farmers decreases as the age increases..

Table 5: Average Allocative Efficiency (AE) Indices of Tuber Crop Farmers and Its Significant Determinants (n =300).

Variables	N	Percentage	Allocative Efficiency (AE)	Mean AE

Farming experience (year)				
1-5	39	13	0.22	0.24
6-10	80	26.7	0.19	
11-15	94	31.3	0.19	
16-20	78	26	0.27	
> 20	9	3	0.34	
Cooperative society membership				
Yes	97		0.23	0.22
No	203		0.21	
Level of Education				
Non-formal education	27	9	0.16	0.27
Adult education	19	6.3	0.21	
Primary	86	28.6	0.22	
Secondary	96	32	0.32	
Tertiary	72	24	0.43	
Age (year)				
< 21	7	2.3	0.32	0.26
21-30	56	18.7	0.23	
31-40	94	31.3	0.23	
41-50	89	29.7	0.29	
51-60	37	12.3	0.33	
> 60	17	5.7	0.15	
Number of Extension contact/year				
0	147	49	0.16	0.22
8	25	8.3	0.17	
12	65	21.7	0.23	
14	23	7.7	0.19	
16	14	4.7	0.29	
20	26	8.7	0.31	
Credit Access				
Yes	69	23.0	0.27	0.25
No	231	77.0	0.22	
Farm size (ha)				
0.01 – 0.50	53	17.67	0.22	0.22
0.51 – 1.00	104	34.67	0.24	
1.01 – 1.50	67	22.33	0.28	
1.51 - 2.00	35	11.67	0.26	
2.01 – 2.50	26	8.67	0.27	
> 6	15	5.00	0.36	

Source: Field Survey, 2013

It is also shown in the Table 5. that efficiency level in the allocation of resources increased with more contact with extension services as the allocative efficeincy index increased from 0.16 to 0.31 with frequency of extension contact increasing from zero contact to maximum of twenty contact per annum. This shows that more access to extension services on awareness of improved technologies on tuber crop production will definitely increase the efficiency of the farmers in the study area. The result further shows that increased in farm size of the tuber crop production also contributed average of 22% of the total allocative efficiency. The allocative efficiency increased among farmers with access to credit in the study area with average allocative efficiency index of 0.27 compared with the farmers without credit access of 0.74 index value

CONCLUSION AND RECOMMENDATIONS

The empirical study is on allocative efficiency of small scale tuber crop farmers in North-central, Nigeria. The DEA result on the classification of the farmers into efficient and inefficient farmers showed that 17.67% of the sampled tuber crop farmers in the study area were operating at frontier and optimum level of production with mean allocative efficiency of 1.00. This shows that 82.33% of the farmers in the study area can still improve on their level of efficiency through better utilization of available resources, given the current state of technology. The results of the Tobit model for factors influencing allocative inefficiency in the study area showed that as the year of farming experience, level of education, cooperative society membership, extension contacts, credit access and farm size increased in the study area, the allocative inefficiency of the farmers decreased. The results on effects of the significant determinants of allocative inefficiency at various distribution levels revealed that allocative efficiency increased from 22% to 34% as the farmer acquired more farming experience. The allocative efficiency index of farmers that belonged to cooperative society was 0.23 while their counterparts without cooperative society had index value of 0.21. The result also showed that allocative efficiency increased from 0.43 as farmer acquired high formal education and decreased to 0.16 with farmers with non-formal education. The efficiency level in the allocation of resources increased with more contact with extension services as the allocative efficeincy index increased from 0.16 to 0.31 with frequency of extension contact increasing from zero contact to maximum of twenty contacts per annum. These results confirm that increase in year of farming experience, level of education, cooperative society membership, extension contacts, credit access and farm size leads to increases efficiency. The results further show that the age of the farmers had 32% input to the efficiency but reduces to an average of 15%, as the farmer grows old. This confirms the findings that efficiency of farmers decreases as the age increases.

In conclusion, the findings of this study showed that 17.67% of the tuber crop farmers in the study area were allocatively efficient in the study area. It is therefore recommended that enhanced research, extension delivery and farm advisory services should be put in place for farmers who did not attain optimum frontier level to learn how to attain the remaining 74.39% level of allocative efficiency through a better production practices from the robustly efficient farms. This will go a long way to increase the efficiency level of the farmers in the study area.

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