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Full Length Article

Analysis of Economic Efficiency of Dry Season Crop Production in Selected Communities of Adamawa State, Nigeria

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ABSTRACT
Dry season crop production is considered one of the major priority areas that have gained major support and incentives from both the federal government of Nigeria and Adamawa State in particular. The research determined the economic efficiency of dry season farming in some communities in Adamawa State, Nigeria. Percentages and stochastic frontier production function was used for the analysis. Multistage stratified and purposive sampling techniques were used in the selection of the local government areas and the respondents for the research..The analysis has shown that the least efficient farmer had economic efficiency of 32 percent with the highest efficient farmer having economic efficiency of 92 percent. A fairly majority of the respondents representing 86 respondents accounted for 53.76% Over all, the average economic efficiencyof the respondents was found to be 61 percent, indicating that the farmers realized just above half of their production potentials; The major positive factors affecting the economic efficiency have been identified to be education, extension and age contact were positively signed and significantly related with economic efficiency as it provided the farmers better access to technical knowledge and possibly helped in enhancing their bargaining power.There are more prospects for further improvement in the economic efficiency of the farmers by appropriate adjustment in their technical and cost efficiencies. It is therefore imperative establish policies that aimed at holistically improving dry season farming possibly through improving farmers' access to credit, timely distribution of productive inputs and increase in the number of extension contacts and encourage them to intensify their efforts particularly on effective resource allocation and utilization to boost farmers' productivity and enhance their capacities in harnessing other ways of increasing income. This can go a long way in improving the economic efficiency of dry season farming.
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INTRODUCTION

Economic efficiency is obtained as a product of technical and allocative efficiency. It is generally concerned with the realization of maximum output in monetary terms with the minimum available resources. As reported (Akinwumi and Djato, 1997) economic efficiency occurs when a farm chooses resources and enterprises in such a way to attain economic optimum. A technically efficient farm by definition is expected to be both technically and allocatively efficient. .However, this definition may not necessarily hold in some cases as in the case of Akinwumi and Djato (1997). Similarly, (Abdul Rahman, 2013.,Girei, 2015) observed that it is possible for a farm to have either technical or allocative efficiency without having economic efficiency. The reason may be that the farmer is unable to make efficient decisions in the utilization of his available inputs. And in some cases, a farmer might fail to equate marginal input cost to the marginal value of his product. However, if it becomes feasible that the farmer's technical and economic efficiency simultaneously occur together which are ideally supposed to be so, and they are both necessary and sufficient conditions for achieving economic efficiency, This implies that the farmer has made right decisions in terms of cost minimization and profit maximization, This invariably implying operating on the highest frontier.

Generally efficiency measurement of agricultural production is an important aspect in any given investment not only the developing nation like Nigeria but worldwide. A measurement of producer performance is very relevant and useful especially in decision making process and policy formulation purposes, and likewise the concept of economic efficiency provides a theoretical basis for such a measure (Russel and Young, 1983).Measurement of resource productivity through efficiency analysis has been a popular field of research since the publication of Farrel Seminal paper in 1957 (Farrel, 1957). Much

research has focused on the economic efficiency of agricultural production, and the analysis has been more on technical, allocative and scale efficiency of farm production (Chavas and Aliber, 1993).

Agriculture serves as the mainstay of most developing countries (Girei, 2015). It is the only means of livelihood of members of the rural communities in those countries, especially in Nigeria. The country's socio-economic history and development has been very closely tied to its agricultural sector (Egbuna, 2008). The country is blessed with varied climatic zones, enormous resources, and has the potential of producing, processing, marketing and exporting different agricultural commodities. In Nigeria, before and immediately after independence, agriculture was the mainstay of the economy, Akangbe (2012). This trend of agricultural contribution to GDP is not consistent with the expected role of agriculture as the economy develops. According to National Bureau of Statistics (NBS, 2014) agriculture contributes about 23% to Gross Domestic Product GDP (Rebased GDP) and a source of food nutrition for Nigerian households. Efficiency analysis is a success indicator that helps in measuring and evaluating the performance of farms. Also, the sources of efficiency differential can only be identified by measuring efficiency and appreciating it effects. Similarly, the measurement will help in the identification of sources of inefficiency that will help the farmers to improve their performance (Abdul Rahman, 2013).

Therefore, the knowledge of resource use is of central importance to the farmers in determining their agricultural productivity. In this regards, low productivity which leads to food insecurity can be overcome in no distance time either through strengthening of production resources or by enhancing their control and management (Ibrahim and Bello, 2009). This has therefore becomes imperative to assess the efficiency of resource use in the study area.

A strong and efficient agricultural sector of the economy would enable the country to feed its growing population, generate employment, improve foreign exchange and provide raw materials for the development of Nigerian industries. Therefore, improved agricultural production processes will be the major instrument in the fight against food insecurity being experienced in the country. This aims at improving rural livelihood and increasing economic growth and development.

METHODOLOGY

The Study Area

The study was conducted in Adamawa State of Nigeria. Adamawa is one of the nineteen Northern States located in the North Eastern part of Nigeria. It lies between latitude 7^0 and 11^oN of the equator and longitude 11^o and 14^oE of the Greenwich meridian. It shares common boundary with Taraba State in the south and west, Gombe State in the northwest, Borno State in the north and an international boundary with the Cameroun republic along its eastern border. The state covers a land area of about 38,741 $km^2$and had a population of 3.168,101 million people from the 2006 population census, National Population Commission (NPC, 2006). The State has a tropical climate with maximum temperature reaching as high as 40^oC between December and January (Adebayo, 1999). The mean annual rainfall pattern shows that the amount range from 700 mm in the north-western part of the state to 1600 mm in the southern part. Generally, mean annual rainfall is less than 1000 mm in the central and north-western part of the state.

The State is endowed with significant hectares of fadama lands suitable for dry season farming using both surface and underground water sources. The fadama land lies along the basins of major rivers, streams, lakes and dams, which are located in the state. Hydrological records of these rivers, streams, lakes and dams show that the water in them could be used for irrigation without drying up. The farmers living along these fadama lands have been practicing small-scale irrigation agriculture on limited potential fadama lands. Agriculture is the major economic sector of the rural communities with mixed farming as the predominant type of farming system practiced.

Data Collection

In this study, primary data collected from 160 dry season food crp farmers belonging to five local government areas of Adamawa State during the 2013//2014 data collected period was used for theresearch. These local government areas were selected purposively since they hadbeen identified to be participants and covered under the fadama II project of the World Bank nationally and state supported fadama farming in Nigeria. From the identified LGAs, farmers were selected randomly and data were collected by personal interview, using a structured survey schedule

Analytical Techniques

Inferential statistics involving stochastic frontier production model was used to examine the economic efficiency of the farmers selected for the research.

Mathematically, the model is specified as follows;

$$InY_{ij}=\beta_o+\beta_1InX_1+\beta_2InX_2+\beta_3InX_3+\beta_4InX_4+\beta_5InX_5+\beta_6InX_6+\beta_7InX_7+\beta_8InX_8 + (v_i- u_i)$$

where Y_i = Output of food crop (kg grain equivalent)

X_1 = Farm size (ha)

X_2 = Quantity of agrochemicals (litres/ha)
X_3 = Quantity of inorganic ferlizer (kg/ha)
X_4 = Family labour(man days)
X_5 = Hired labour (man days)
X_6 = Ploughing (man days)
X_7 = Quantity of water (liters)/ha)
X_8 = Quantity of seeds (kg/ha)
In = logarithm to base e ij = j^{th} observation of the i^{th} farmer
V_i-U_i= error term (ε)
βo = constant term to be estimated
$\beta_1$to β_8 = coefficients of the independent variables to be estimated
The corresponding cost frontier of Cobb- Douglas functional form was used as the basis of estimating the allocative efficiencies of the food crop production farmers in the study area. The implicit form of the cost frontier production formfor Adamawa State fadama food crop farmers is given as follows;

$$InC=\alpha_0+\alpha InP_1+\alpha InP_2+\alpha InP_3+\alpha InP_4+\alpha InP_5+\alpha InP_6+V_i+U_i \quad (3.6)$$

Where C = Total cost of production (₦)
P_1 = Cost of hiring land (₦)
P_2 = Cost of agrochemicals (₦)
P_3 = Cost of fertilizers (₦)
P_4 = Cost of family labour (₦)
P_5 = Cost of hired labour (₦)
P_6 = Cost of ploughing (₦)
P_7 = Cost of water (₦)
P_8 = Cost of seeds (₦)
The technical and allocative inefficiency model $\mu_i j_i s$ defined by:

$$\mu_{ij} = \delta o + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5$$

μ_{ij} = denotes the cost inefficiency of the i^{th} farmer
Z_1 = denotes years of farming experience of the i^{th} farmer
Z_2 = Years of formal education
Z_3 = Extention contacts (number of meetings)
Z_4 = denotes household size
Z_5 = Age of farmers in years
δ_o = constant term
δ_1 to δ_1 = unknown parameter to be estimated

RESULTS AND DISCUSSION

Economic Efficiency

Economic efficiency of the farmers which is obtained as the product of technical and allocative efficiency scores or the combined effect of technical and economic efficiencies is important in determining the overall economic outlook of the general performance of afarm. Therefore, the maximum likelihood (ML) estimates of the stochastic frontier function of the respondents are presented in Table 1 below. The frontier production function analysis has shown that variation in the economic efficiency levels among the respondents is large, with a minimum efficiency of 0.32 (32%), and a maximum efficiency of 0.92 (92%). The average economic efficiency is estimated to be 0.61 (61%), an indication that the farmers realized only above half, indicating that the farmers are fairly economic efficient in dry season food crop production. The frequency distribution of economic efficiency scores of sampled respondents as presented in Table 1 further showed that given the level of output with a minimum quantity of inputs under certain state of technology majority of the respondents who participated in the dry season farming falls around o.49. The minority of the farmers had the ability to produce a given level of output with a minimum quantity of inputs under certain technology lower than 0.3 that was 7.5% with farmers within the range of 0.8 and 0.89 represented 1.25%.For an average farmer to attain the level of the most economically efficient farmer there must be an efficiency gain of 31% given the available resources and the current state of technology. Also, an average farmer needs an efficiency gain of 39% to attain the maximum economic efficiency frontier.

The analysis further revealed that about 7.5 % representing 12 of the farmers had economic efficiency level of less than 40%, while about 14.38 which constituted 23 respondents had efficiency level of between 40 and 49%. About 39 of the farmers resulting to about 24.38% obtained economic efficiency level of 50 to 59%, with majority of the farmers constituting 51 respondents and accounted for about 31.88 % fall within the range of 60 to 69 %. Similarly, a total of 18 respondents which accounted for about

11.25% had efficiency range of 70 and 79%. In addition, respondents within the category of 0.8and 0.89 constituted15 respondents and accounted for 9.38% while only 1.25% had efficiency level of 90% and above.

Table 1: Distribution of economic efficiencies among the respondents

Range of efficiency	Frequency	Percentage
< 0.30	12	7.50
0.30 - 0.39	23	14.38
0.40 - 0.49	39	24.38
0.50 - 0.59	51	31.88
0.60 - 0.69	18	11.25
0.70 - 0.79	15	9.38
0.80 - 0.89	2	1.25
Total	160	100
Mean 0.61		
Maximum 0.92		
Minimum 0.32		

Source: Field Survey, 2013

The shown by the level of economic efficiency obtained in this study, it suggests that there are great opportunities that exist for the farmers to increase their productivity and income through increased efficiency in resource utilization in their farm operation activities.

Sources of Economic Efficiency

Table 2 shows that the coefficients of education, age of the respondents, farming experience, farm size and extension contact were all positive and identified as significant factors influencing the economic efficiency of farmers.

A second stage analysis was conducted to evaluate the influence of selected socio-economic characteristics on the economic efficiency of respondents and is contained in Table 2. These characteristics includes; farming experience (X_1), education (X_2), extension contacts (X_3), Household size (X_4) and age (X_5). The results of the analysis reveal that education and extension contact were positively signed and significantly related with economic efficiency.

Education and extension contact have been identified as catalysts in technology adoption that enhanced economic efficiency of farmers in Nigeria. Generally people with some level of education tend to be more active in learning and decision taking. It also gives them more opportunity to decide on various options available to them that will eventually help in right decision. Extension services, which refer to various contacts made in terms of sharing ideas, information, innovation among others helps in re-orienting farmer's attitude in terms of adoption of new and modern ideas of doing things especially in determining the performance of specific technology being introduced. Education is positively related to economic efficiency and implies the higher the educational attainment of the farmer the higher his efficiency. This might possibly due to his ability to understand and compare various options available to him for effective decision making. This finding is in line with the studies conducted by (Obasi,200., Gireiand Dire, 2013) who observed that the level of education of a farmer plays an important role in not only increasing his farm productivity but also enhances his ability to understand, comprehend and evaluate new production techniques that may be available to him.

Age of the respondents were found to be significant at 5 percent but negatively related to economic efficiency which is also in line with *apriori* expectation. This result is consistent Iheke (2010). He reported that the older a farmer advances in age, the more he is likely to be unable to combine his or her resources in an optimal manner given the available technology and the circumstances of his state of mind. In this regard, it is essential that economic policies and programmes for enhancing dry season crop production should be skewed more towards encouraging the youths to get involved in farming so as to gradually take over from the ageing farmers.

Extension services through the change agent agents are very critical to the success of farmers in achieving high productivity through learning of new ideas, techniues and inavations the may likely be avail to them. This could be obtained through informal training that helps to unlock the natural talents and inherent enterprising qualities of the farmers, enhancing his ability to determine, understand, innovate and evaluate new production technologies leading to increased agricultural productivity and incomes with great potential of improving the quality of life and other social variable of farmer (Nwaru, 2004). It is essential to report that farmers' interactions with extension agents would help them to receive and synthesize new information on economic activities in his locality and beyond. The positive and significant relationship between extension contact and economic efficiency implies that the higher the number of

contacts a farmer made with an extension agent, the greater his economic efficiency, which is in consonance with *a priori* expectations.

Farming experience which is invariably the age in farming plays an inportant role in decision making regarding the resource allocation, type of enterprise to partcipate in based on its expected positive return. The analysis observed that years in farming is significant at 5 percent probability level and positively related to economic efficiency. This result is also in consistent with *apriori* expectations and has some positive implications for increased crop productivity because according to Girei *et al*, (2015), the number of years a farmer has spent in the farming enterprises, the more likely of loses minimization and this may provide an indication of the practical knowledge he has acquired in the course of his business especially on how he will overcome certain constraints and problems associated to farm production. Therefore, itis opine that sustainable policies that harness the experience and practical knowledge of the farmers for increased productivity should be advocated and promoted.

Household size has also been identified to be significant at 10% level on economic efficiency. This may mean the larger the household size, possibly the higher the availability of man power required to carry-out some of the farm operations which eventually will lead to cost savings on farm activities and hence more support in-terms of meeting family obligations that will in turn help in improving their economic activities.

Table 2: Relationship between Socio - Economic Variables and Economic Efficiency.

Variable	Economic Efficiency
X_1(Farming experience)	0.007(1.034) **
X_2 (Education)	0.004(2.126)**
X_3 (Extension contact)	0.067(4.049)**
X_4 Household size)	0.005(2.149) ***
X_5 (Age)	- 0.003(2.212) **
Constant	0.674 (11.223)***
R-squared	0.54
Adjusted R-squared	0.48
F-statistic	5.809***

Source: Field Survey, 2013

Figures in parentheses are standard errors of the coefficients

CONCLUSIONS

The research concluded that there was wide range of economic efficiencies which exist among the farmers with a mean efficiency of 0.61 an indication that there is an ample opportunity for further improvement which could be achieved through appropriate re-adjustment of production inputs. Farming experience, education, extension contacts, household size and age were the significant factors affecting the economic efficiency of the respondents. Adequate enlightenment and education of the farmers is therefore recommended so as to improve efficiency and this calls for the strengthening of the agricultural extension systems which will help in providing the medium for the promotion of improved innovations and other related technologies. Also, the efficiency of the farmers could be improved through improved farmer specific efficiency factors, which include access to improved seeds and crop diversification. Doing so will help in increasing crop productivity per unit as may be revealed through continuous efficiency and productivity analysis.

REFERENCES

1. A. Girei, and B. Dire. (2013). Impact of National Fadama II Project on the Socioe-conomic Characteristics of Crop Farmers in Adamawa State, Nigeria.I*nternational Journal of Innovative Agriculture & Biology Research.*1 (2):31-38
2. Abdul Rahman, S. (2013). Farm Production Efficiency: The Scale of Success in Agriculture: The Fourth Inaugural Lecture. Nassarawa State University, Keffi, Nigeria
3. Adebayo, A.A. (1999). "Climate 1 (Sunshine, Temperature, Evaporation and Relative Humidity)", *Adamawa State in Maps*. Adebayo, A.A. and Tukur, A.L. (eds.), Department of Geography, Federal University of Technology, Yola.20-26.

4. Akangbe, J. A., Ogunyinka, W., Ayanda, I. F., Achem, B. and Adisa, R. S. (2012).An Assessment of Effects of Fadama Ii Project On Livelihood Of Farmers In Orire Local Government Area Of Oyo State, Nigeria. *Nigerian Journal of Agriculture, Food and Environment*. 8(1):27-32
5. Akinwumi, A. and Djato, K. K. (1996).Fram Size, Relative Efficiency and Agrarian Policy in Cote d'Ivoire:Profit Function Analysis of Rice Farms. *Agricultural Economics*, 14:93 - 102
6. Assessment of Effects of Fadama Ii Project On Livelihood Of Farmers In Orire Local Government Area Of Oyo State, Nigeria. *Nigerian Journal of Agriculture, Food and Environment*. 8(1):27-32
7. Chavas, J.P and Aliber, M. (1993). An Analysis of Economic Efficiency in Agriculture: A Nonparametric Approach. *J. Agr. Resour. Econ*. 18:1 - 10
8. Egbuna, E.N. (2008). A Review of the Activities of the National Strategic Grains Reserve:
9. Farrel, M.J. (1957).The Measurement of Productive Efficiency.*J. Roy. Statist.Soc:,* Series A (General). 120: 253 - 81
10. Girei, A. A. (2015). Analysis of Production Efficiency in Fadama II Farming in Adamawa State.Unpublished Ph.D Thesis.ModibboAdama University of Technology, Yola, Nigeria
11. Ibrahim, H. and M. Bello, (2009) 'Food Security and Resource Allocation among Farming Households in North Central Nigeria.'*Pakistan Journal of Nutrition* 8 (8): 1235-1239.
12. Iheke, O. R. (2010) Impact of Migrant Remittances on Efficiency and Welfare of Rural Smallholder Arable Crop Households in South Eastern Nigeria. PhD Dissertation, Michael Okpara University of Agriculture, Umudike.
13. National Population Commission (NPC) (2006). National Population and Housing Survey.National Population Commission, Abuja, Nigeria.
14. NBS, (2014). Nigeria GDP Growth Rate-Nigeria Becomes Africa's Largest Economy.
15. Nwaru, J.C. (2004) Rural Credit Markets and Resource Use in Arable Crop Production in Imo State of Nigeria. PhD Thesis Michael Okpara University of Agriculture, Umudike.
16. Obasi, F. C. and Agu, S.E. (2000).Economics of Small Scale Rice Farming Under Different Production Systems in South Eastern Nigeria. J. Agric. Business Rural Develop. 1:2
17. Russell, N.P and Young, T. (1983).Frontier Production Function and the Measurement of Technical Efficiency. *Journal of Agricultural Economics*. 34: 139 - 50