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COMPARATIVE ANALYSIS OF ROOT AND TUBER EXPANSION PROGRAMME IN KWARA STATE, NIGERIA

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ABSTRACT
The Nigerian government over the years introduced and implemented several policies and programmes aimed at improving the agricultural sector and enhancing farmers' welfare. However, very little is known about the impact of these programmes on the intended beneficiaries to justify the huge funds expended on their execution. This study therefore examined how the Root and Tuber Expansion Programme (RTEP) had impacted on root and tuber crops production of the beneficiaries in Kwara State, Nigeria. A combination of purposive and random sampling techniques was used to select 60 beneficiaries and 60 non-beneficiaries of the programme. Data were analyzed using descriptive statistics, Data Envelopment Analysis, and T-Test Analysis. The mean Total Factor Productivity index for the beneficiaries was 4.94 while that for the non-beneficiaries was 3.92. The mean technical efficiency score was 0.92 for beneficiaries and were more efficient than the non beneficiaries who had a technical efficiency score of 0.71. The study concluded that RTEP had made some positive impact on its beneficiaries in Kwara State and the capital investment in the programme by both the Federal and State Governments is justifiable. This study recommends that the programme should be expanded to cover all local government areas in the state to ensure a wider spread of the project benefits and that continuity of the programme beyond the project period should also be given due consideration.

Key words: Root and Tuber Expansion Programme, Technical Efficiency

INTRODUCTION
A number of policies and programmes have been introduced by the Nigerian government to increase agricultural outputs (Ayinde, 2008). A recent effort towards improving production and enhancing farmers' welfare was the introduction of Root and Tuber Expansion Programme (RTEP). As a follow up to the International Fund for Agricultural Development(IFAD) supported Cassava Multiplication Project (CMP) which had the objective of multiplying, distributing and promoting the use of improved cassava varieties with a view to increasing root and tuber farmers' productivity and income and consequently raising their standard of living. Root and tuber crops also referred to as root crops contribute significantly to income and food security in developing countries. The major roots and tubers; cassava, yam, potatoes occupy about 50million hectares worldwide (Horton and Monares, 1984). Roots and tubers have multiple uses, most notable as food security crops, regular food crops, and cash crops. They are increasingly being used as livestock feed and raw materials for industrial purposes. Roots and tubers have long served as the principal source of food and nutrition for many of the world's poorest and undernourished households and are generally valued for their stable yields under conditions in which other crops may fail (Alexandratos 1995, & Scott et al 2000). Root and tuber crops produce remarkable quantities of energy per day even in comparison to cereals. Potatoes lead the way in energy production,

followed by yam. In addition, some root and tuber crops are important sources of vitamins, minerals and essential amino acids such as lysine (Low, Kinyae, Gichuki, Oyunga and Kabira, 1997&Woolfe, 1992). In spite of their importance African food policies over the last half a century have focused on achieving growth and self sufficiency in cereals with growth rates in roots and tubers over this period largely driven by area expansion as opposed to yields (Scott et al, 2000, 5: Nweke, 2004). Nigeria produces roughly 40 percent of all the root and tuber crops in Africa. Aside from being the largest producer of cassava producing 35 percent of Sub-Saharan Africa production. 70 percent of yam production in Sub-Saharan Africa is traceable to Nigeria production (Kenyon, Anandajayasekeram, and Ochieng, 2006). However, processing and storage processing technologies, poor product prices as well as limited product utilization and marketing opportunities have constrained the maximization of the benefits of increased production of these crops in Nigeria and have only translated into limited income for producers of the crops. It is in a bid to confront these challenges through the development of appropriate processing technologies and product utilization for cassava and other root crops that the Root and Tuber Expansion Programme (RTEP) was formulated by the Food and Agricultural Organisation (FAO) Investment Centre in 1995.The programme is based on the principles of grassroots participation, small farmer focus, involvement of women and youth and enhancement of entrepreneurship by small holder producers in provision of Agricultural services such as harvesting, pest control and agro-processing(Ugwu, 1996). Capitalizing on the achievements and lessons drawn from CMP, RTEP was extended to other roots and tubers such as yam, Irish potato, sweet potato and cocoyam as well as their end-products with emphasis on processing and marketing, in order to enhance national food self-sufficiency and improve rural household food security and income within the Southern and Middle belt states of Nigeria. RTEP was approved by IFAD Executive Board in 1999 and the Federal Government of Nigeria signed the loan of 23.05million U.S. Dollars in May, 2000 which was declared effective on 31st July, 2001 and disbursement by IFAD was made in June, 2003. The huge capital investment that the Federal Government has committed to RTEP calls for an in-depth assessment of the impact of the project on its beneficiaries and non-beneficiaries. Accurate and reliable information on the impact of the programme on its beneficiaries would be of immense importance to policy makers and of use in the designing of such programmes in the future. In view of this, the study was developed to achieve the following objectives; describe and compare the socio-economic characteristics of the beneficiaries and non-beneficiaries of the programme; determine and compare total factor productivity of the beneficiaries and non-beneficiaries; and to evaluate and compare technical efficiencies of the beneficiaries and non-beneficiaries. The following null hypothesis were stated and tested:

- There is no significant difference in the total factor productivity of the beneficiaries and non-beneficiaries of the RTEP
- There is no significant difference in the technical efficiency of the beneficiaries and non-beneficiaries of the RTEP

METHODOLOGY

Study Area

This study was carried out in Kwara State, Nigeria. The state has 16 Local Government Areas with a population estimate of about 2,371,089 (National Population Commission, 2006). The State lies between longitude 4^0-6^0 East of the Greenwich meridian and between latitude 8^0-10^0 North of the Equator. The total land area of the State is put at 32,000 square kilometer representing about 6.54% of the total land area of the country (Kwara State Agricultural Development Project, KWADP, 2000). The State shares common boundaries with Oyo,

Osun, Ondo, Niger, Ekiti, Kogi and Kebbi States of Nigeria. The daily temperature ranges between 21^0C-33^0C with an average rainfall pattern of 14995-15,000mm.There are two main climate seasons, the dry and wet seasons with an intervening cold and dry harmattan period usually experienced from December to January (KWADP, 2000). The natural vegetation consists broadly of rain forest, Guinea savannah in the extreme north with a Fadama belt along the River Niger. The vegetation of the State makes it suitable for the cultivation of several cash and food crops. Some of the food crops grown in the state include yam, cassava, sweet potato, sorghum, cowpea etc as enumerated by KWADP. Kwara State has an estimated figure of 203,833 farm families with the majority living in rural areas (KWADP 1996). The state is divided into four main agro-ecological zones in consonance with the ecological characteristics, cultural practices and administrative convenience by the Kwara state Agricultural Development project as given below: Zone A: Baruteen & Kaima; Zone B: Edu and Patigi; Zone C: Asa, Ilorin East, Ilorin South, Ilorin West & Moro; Zone D: Ekiti, Ifelodun, Irepodun, Isin, Offa, Oke-Ero & Oyun.

Data Source/Sampling Technique

Primary data on the socioeconomic characteristics of the respondents, quantity and cost of various production inputs used during production process and outputs obtained was collected through the use of structured questionnaire. Kwara State is divided into four agro-ecological zones A, B, C, D, by the Kwara State Agricultural Development Project. Zone D was purposively selected out of the 4 ADP zones due to the large number of the programme participants (Ifelodun and Oyun Local Government Areas) in the zone. Six out of the ten farmer groups in the selected zone were then randomly selected. Ten (10) farmers were randomly selected from each of the six farmers' group making a total of 60 farmers who participated in RTEP. 60 farmers who did not participate in the RTEP were also randomly selected from the zone to arrive at a total of 120 respondents for the study. However, only 59 and 54 questionnaires for the beneficiaries and non beneficiaries respectively were retrieved and found useful for analysis.

Analytical Technique

Simple descriptive statistics was used to attain the objective bordering on the socio-economic and demographic characteristics of the beneficiaries and non-beneficiaries of the programme. While the Total Factor Productivity Analysis was used to measure the level of productivity of the beneficiary and non beneficiary farmers, Data Envelopment Analysis was used to measure the technical efficiency of the beneficiary and non beneficiary farmers and T-Test analysis was used to compare the parameters of the two groups.

Total Factor Productivity Analysis

Total factor productivity can be measured as the inverse of unit variable cost (Fakayode et al, 2008, Ibrahim & Onuk, 2010).

$$TFP = \frac{Y}{TVC} \qquad \ldots\ldots(1)$$

Where Y = Value of output in Naira (₦)
TVC = Total variable cost in Naira (₦)

The total variable cost (TVC) includes the cost of labour, seeds, fertilizer, and herbicide.

Data Envelopment Analysis

DEA is a linear programming methodology used to measure the efficiency of multiple decision-making units (DMUs) when the production process presents a structure of multiple inputs and outputs. DEA has the benefit of not assuming any parametric form and it takes into consideration returns to scale in calculating efficiency, allowing for the concept of increasing or decreasing efficiency based on size and output levels; however, it does not provide a general relationship relating output and input and does not impart any useful information on the production processes involved in the firms. Models of it can be developed, to assess allocative and scale efficiencies, congestion, and overall economic efficiency (Fare, et al 1994). Linear programming (LP) models are developed to undertake the DEA and for the purposes of simplicity, these can be referred to as DEALP models.Given N decision making units (DMU) producing M products using K inputs, the input and the output vectors will be represented by X and Y respectively. For each DMU, all data may be written in terms of K^xN as input matrix (x) and M^xN as output matrix (y). Thus, technical efficiency for DEA model can be obtained from

Min $\theta > \theta$

St $-yi + Y\lambda \geq 0$ ……(2)

$\Theta x_1 - X\lambda \geq 0$ …… (3)

$N1'\lambda = 1 \geq 0$…….. (4)

$\lambda \geq 0$

Where Θ is the expected value of input technical efficiency of DMU ranging between 0 and 1, meanwhile λ is a vector of constant or N^x1. Y λ and X λ are the efficient projections on the frontier. N_1 λ = 1 is the convexity constraint which makes the model to have a variable returns to scale (VRS) specification (Ibrahim and Onuk, 2010). Without which, the model will have a constant return to scale (CRS). Thus, the linear programming needs to be solved N times and a value of Θ is provided for each farm (DMU). The input considered include: land(ha), planting materials (in naira), labour (in naira) and herbicide (in naira) while the output will be the yield of root and tuber crops obtained in monetary terms (in naira). The value of q obtained will be the efficiency score of the i-th DMU. It will satisfy with a value of 1 indicating a point on the frontier and hence a technically efficient DMU according to the Farrell (1957) definition. The analysis was conducted by using a computer program DEAP (Coelli, T., 1996).

T-Test Analysis

T-Test analysis was be used to compare the results from the analysis. The *t* statistic to test whether the means are different was calculated as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1X_2} \cdot \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where

$$S_{X_1X_2} = \sqrt{\frac{(n_1 - 1)S_{X_1}^2 + (n_2 - 1)S_{X_2}^2}{n_1 + n_2 - 2}}.$$

$S_{X_1X_2}$ is an estimator of the common standard deviation of the two samples. In these formulae, *n* = number of participants, 1 = Group 1 (beneficiaries of RTEP) 2 = group two (non-beneficiaries of RTEP). $n - 1$ is the number of degrees of freedom for either group, or

the total sample size minus two (that is, $n_1 + n_2 - 2$) is the total number of degrees of freedom, which is used in significance testing.

RESULTS AND DISCUSSION

Table 1 gives a summary of the socioeconomic and demographic characteristics of the respondents

Table 1: Socioeconomic and Demographic Characteristics of the Respondents

Characteristics	Beneficiaries		Non-Beneficiaries	
	Frequency	Percentage	Frequency	Percentage
Gender				
Male	45	76.30	41	75.93
Female	14	23.70	13	24.07
Total	**59**	**100**	**54**	**100**
Age(years)				
<30	1	1.70	7	12.96
31-50	34	57.60	29	53.71
>50	24	40.70	18	33.33
Total	**59**	**100**	**54**	**100**
Marital status				
Single	1	1.70	11	20.37
Married	58	98.30	43	76.63
Total	**59**	**100**	**54**	**100**
Educational Status				
No formal Education	12	20.34	29	53.71
Quaranic Education	8	13.56	7	12.96
Primary Education	11	18.66	7	12.96
Adult Education	5	8.47	4	7.41
Secondary Education	16	27.12	7	12.96
Post Secondary Education	7	11.86	-	-
Total	**59**	**100**	**54**	**100**
Household Size				
1-3	6	10.20	9	16.67
4-6	28	47.50	21	38.87
7-9	14	23.70	16	29.63
>10	11	18.60	8	14.81
Total	**59**	**100**	**54**	**100**
Mode of Land Acquisition				
Inherited	47	79.70	43	79.63
Owned	7	11.90	9	16.67
Leased	5	8.40	2	3.70
Total	**59**	**100**	**54**	**100**
Farm Size(Ha)				
<1	4	6.80	15	27.78
1-2	32	54.20	26	48.15
>2	23	40.00	13	24.07
Total	**59**	**100**	**54**	**100**
Usage of Herbicides				
Yes	46	78.00	23	42.59
No	13	22.00	31	57.41
Total	**59**	**100**	**54**	**100**
Usage of Fertilizer				
Yes	46	78.00	24	44.44
No	13	22.00	30	55.56
Total	**59**	**100**	**54**	**100**
Access to extension services				

Yes	56	95.00	20	37.04
No	3	5.00	34	62.96
Total	**59**	**100**	**54**	**100**

Source: Field Survey 2012

As shown in table 1, about 76 percent of the beneficiaries are males while 23.7% are females and this is about the same for the non-beneficiaries. This shows males are more engaged in root and tuber crops farming in the study area. This may be as a result of the stress associated with farming activities in the study area. The modal age group for the beneficiaries is 31-50years with an average age of 51 years. For the non beneficiaries, the average age is 54 years. This implies that youth participation in farming activities in the study area is low. 98.3% of the beneficiaries are married and for the non-beneficiaries, 76% are married. About 56% of the non-beneficiaries have no formal education as against about 20% of the beneficiaries with none of the non-beneficiaries having post secondary education. The beneficiaries appear better educated on the average. The mean household size of the beneficiaries is 7 while for the non-beneficiaries have a mean household size of 6. Most of the beneficiaries (79.7 percent) and non-beneficiaries (67.6 percent) inherited their farmlands. This may be due to the fact that sales of land in the study area are not a common phenomenon. Only about 24% of the non-beneficiaries cultivated land area greater than 2 hectares Compared to the 40% in the case of the beneficiaries. This may be as a result of the fact that the beneficiaries are more united as a group than the non beneficiaries. About 78% of the beneficiaries used herbicides on their farms while only about 42% of the non-beneficiaries used herbicide. This is not unconnected to the fact that the programme beneficiaries have better access to inputs. More than 50% of the non-beneficiaries did not used fertilizer whereas about 78% of the beneficiaries used fertilizer probably because provision of fertilizer was a part of the beneficiaries. Almost all the beneficiaries have access to extension services as against that less than 50% among the non-beneficiaries. This may be mainly due to the fact that the programme involves the provision of extension services to the beneficiaries.

Total Factor Productivity of the respondents

Table 2 gives a summary of the Total Factor Productivity of the respondents

Table 2: Total factor productivity indices of the respondents

Total Factor Productivity	Beneficiaries		Non-Beneficiaries	
Range	Frequency	Percentage	Frequency	Percentage
0.1-3.00	11	18.64	18	33.33
3.01-7.00	11	18.64	18	33.33
>7.00	13	22.04	8	14.82
Total	**59**	**100**	**54**	**100**

Source: Field survey, 2012

Majority of the beneficiaries had a total factor productivity ranging from 3.01-7.00. This represented about 59.3% of the beneficiaries, while for the non-beneficiaries it is about 52%.

The average total factor productivity index for the non-beneficiaries' was 3.92 which is lower than that of the beneficiaries which was 4.936.

T-test analysis for productivity

A summary of result for the T-test analysis is given in table 3

Table 3: T-test analysis for productivity

TFP	**N**	**Mean**	**SD**	**SEM**	**T-value**	**Sig**
Beneficiaries	59	4.9360	3.43710	0.44747	-3.056	0.003
Non beneficiaries	34	12.3474	18.14031	3.11104		

Source: Field survey, 2012

The difference was statistically significant at ($P < 0.05$).

As shown in table 3, The difference in the productivity was found to be statistically significant at 5% level of significance ($P < 0.05$). Hence, the null hypothesis that there is no significant difference in the total factor productivity of the beneficiaries and non-beneficiaries of the RTEP was rejected. This implies that the non-beneficiaries of the programme incurred more cost per unit of output compared to the beneficiaries.

Technical efficiency of the respondents

A summary of the technical efficiency scores of the respondents is given in table 4.

Table 4: Technical efficiency scores of the respondents

Technical Efficiency Score	Beneficiaries		Non-Beneficiaries	
Range	Frequency	Percentage	Frequency	Percentage
<0.5	2	3.39	13	24.07
0.51 - 0.75	11	18.64	28	51.86
0.76 – 1	46	77.97	13	24.07
Total	**59**	**100**	**54**	**100**

Source: Field survey, 2012

About 78% of the beneficiaries have a technical efficiency score ranging between 0.76 and 1 with a mean technical efficiency score 0f 0.92. This implies that the output of root and tuber crops among the beneficiaries can be increased by about 8% with the existing level of input usage. As for the non-beneficiaries**,** about 52% of them have their technical efficiency scores ranging between 0.51 and 0.75 with a mean score of 0.71. This implies that the output of root and tuber crops among the non-beneficiaries can be increased by about 29% with the existing level of input usage.

T-test Analysis for Technical Efficiency

Table 5 gives a summary of the result of T-test analysis for technical efficiency

Table 5: T-test analysis for technical efficiency
Source: Field survey, 2012

Technical efficiency	N	Mean	SD	SEM	T-value	Sig
Beneficiaries	59	0.960	0.07208	0.00938	6.784	0.000
Non beneficiaries	34	0.782	0.17694	0.03035		

As shown in table 5, the difference in technical efficiency between beneficiaries and non beneficiaries was statistically significant at 5% level of significance ($P < 0.05$). Hence, the null hypothesis that there is no significant difference in the technical efficiency of the beneficiaries and non-beneficiaries of the RTEP was rejected. This may be due to the fact that the programme package provides extension services support, improved planting materials and funds for the beneficiaries. A similar finding was made in a study by Ibrahim and Onuk, 2010 in which RTEP was examined in Nasarawa State.

CONCLUSION

This study compared the total factor productivity and technical efficiency of the beneficiaries and non-beneficiaries of the Root and Tuber Expansion Programme (RTEP) in Kwara State, Nigeria. It was found that the programme had a positive effect on the production of the beneficiaries given their higher technical efficiency and higher Total Factor Productivity when compared to those of the non-beneficiaries. It is therefore recommended that the programme be given a wider coverage so that more farmers can benefit from the programme. Continuity of the project beyond its planned period should also be given due consideration. Proper education of the project beneficiaries is also essential. Female root and tuber crop farmers should also be mobilized to participate in the programme.

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