Efficiency Differential of Government and Non Government Assisted Rice Farms: A Case Study of Kwara State, Nigeria.

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Abstract: This study analysis the technical efficiency differential of government and non government assisted rice farms in the Duku River Basin of Patigi Local Government Area of Kwara State, Nigeria. It also identified the socio-econmic factors, which affect the efficiency. The Net Farm Income per hectare of land cultivated was calculated as profitable for the two farm sites. The project site, with gross margin of N9, 376.35 is more profitable when compared to the non-project site with a gross margin of N29, 515.35. The rate of returns to rice production at the project and non-project sites was estimated at 93.3% respectively, which indicated that for every N1 invested in each of the sites N0.93k and N0.31 was expected as profit respectively. These technical efficiencies were estimated using the Cobb-Douglas Stochastic Frontier Production Function. The result indicates that technical inefficiency is present and is a mean function of farming specific variables. The mean Technical efficiency of the projects sites (Rice Farm) is estimated as 0.98 while that of non-project site is 0.80. There was a significant difference between the mean T.E. for the two farms. The higher efficiency estimate obtained for the rice farms at the project site can be attributed to the government assistance to the farmers in the form of input/output linkages. It is therefore justifies institutional support and that all kinds of institutional support should be encourage if rice production are to be improved in the study areas.

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1. Introduction

Agriculture has been an important sector in the Nigeria economy in the past decades and is still a major sector despite the oil boom; basically it provides employment opportunities for the teeming population, eradicates poverty and contributes to the growth of the economy (Izuchukwu, 2011). Of Nigeria's estimated 69.9 million hectares of agricultural land about 39.2 million are under permanent pasture with another 2.8 million under permanent crops, leaving about 27.9 million ha for arable crops. Within the last category, it is estimated that some 25 million hectares are cultivated each year implying a high cropping intensity with respect to arable land. Forestry constitutes about 26 million hectares currently. Crops contributes some 27% of GDP, livestock another 3.3% and forestry and fisheries 1.5%. A list of the country's agricultural exports include cocoa, cotton, vegetables and fruits, leather and these exports represent less than 5% of export earnings (ADB, 2005).

Nigeria has managed to keep itself alive in food production, perhaps because of the rural nature of our agriculture that has left the practice of agriculture in the hand of small private farmers or ordinary individuals. The small-scale family farms commonly operated are characteristic of the level of development in Nigeria. With personal or borrowed capital are put into the enterprise, there are assumptions of all chances of gains or loss (Olayide and Heady, 1982). In addition to doing all the organizing and supervision alone, the bulk of the farm labour is performed by the individual farmer and members of his family (Olayide and Heady, 1982). These small-scale farms are operated under many complex systems of cultivation like bush fallowing or shifting cultivation which also varies depending upon the types of crops and the prevailing social- cultural norms in the area (Ayoola, 2001). These systems of farming are characterized by crude farm tools, rain dependency, low input level, low outputs, low income and the farmers are often price takers. These types of farming, opined Olayide and Heady (1982), are not capable of attaining the optimization and/or maximization as well as productivities characteristic of modern and scientific system of farming.

Olubiyo and Adewumi (1997) also submitted that large-scale farms in Kwara State are more efficient when compared to these small-scale farms. Their study however concluded that efficiency is a relative term and is influenced by various factors such as the type and quantum of resources available, managerial ability, technology and environment factors which farmers are

faced with.

It is often suggested that one of the strategies for increasing agric productivity is to increase the level of farm resources as well as make efficient use of the resources already committed to the farm sector. However, agricultural productivity may not be substantially increased by simply increasing all inputs in the traditional state but by a package approach to technology (Babatunde, 2003).

Since 1976, various agricultural programmes have been initiated to stem the declining fortunes in the agricultural sector. Among such programmes initiated are the Operation Feed the Nation, Green Revolution, the National Livestock Project, River Basin Development and the World Bank Assisted Agricultural Development Projects (PCU, 2002). In spite of all these laudable initiatives, the agricultural sector in Nigeria has been unable to make substantial contributions to Nigeria's gross domestic product. Evidently, the advent of oil boom has been largely responsible for the relegation of agriculture to the background of our economy. The decline in the agricultural sector has had a resultant effect in our inability to achieve self-sufficiency in food production and as well source adequate raw materials for our agro-allied industries (Ayoola, 2001). Allied with the aforementioned are the new problems of rapid population growth coupled with environmental degradation that have arisen. From an overall perception, considering recent trend and current estimates of over 100 million people in Nigeria, there is cause for greater concern with respect to the little progress in agricultural development and the worsening economic and food insecurity situation (FAO, 2001).

When the present Civilian Administration in Kwara State assumed office in May 2003, it stated that one of its key concerns would be the acceleration of agricultural production (Kwara SEEDS Document, 2003). To this end, a two-prong strategy of revamping agriculture in the state was laid out thus:-

(i) Increasing commercial farm production and

(ii) Small-scale farm production.

So far, various agricultural schemes have been initiated and facilitated, notable among them are:

(i) The commercial farming schemes as exemplified by the farmers from Zimbabwe and the "Coga" Commercial farms established by indigenous Nigerian entrepreneurs.

(ii) Small-scale farming initiative as exemplified by the Back to farm.

(a) The Molete Youth Farming scheme

(b) Tractor loan schemes for farmers' Cooperatives

(c) Cassava production/ post-harvest scheme

(d) The rehabilitation of the Duku-Lade Irrigation scheme for rice farmers among others (Kwara ADP PME Annual Report, 2005 and Kwara State Ministry of Agriculture 2004).

However, it is worthy to note, that limited known independent research work exists, to buttress the widely acclaimed success of the Kwara state Government in the realm of Agriculture. Akanbi et al, 2011, only examines the technical efficiency of the project farm sites under the Duku-Lade government assisted project farm. Although Akanbi et al, 2011 mentioned in their study the concern about the technical efficiency differentials of rice farms that enjoy government patronage and those surrounding farms that do not enjoy the same privilege sites, but did not examine this concern and hence this concern resulted into this study. Of particular interest to this study is the Government's Duku-Lade Irrigation scheme, located in Lade District of Patigi Local Government Area of Kwara State. The researcher is therefore interested in the extent of the differential in the technical efficiency of the project farm sites under the Duku-Lade government assisted project farm sites and the adjoining non - project ones with a view of identifying those factors that affects their levels of efficiency. Hence the main objective of this study is to compare technical efficiency in rice production at the Duku-Lade government assisted projects site with the privately owned sites the study areas. The specific objectives are to: compare the costs and returns to rice production, between farms at the project and those at the non-project sites; determine the socio-economic factors affecting the level of efficiency of the rice farms; estimate the technical efficiencies of the rice farms at the project and non-project sites.

The limited capacity of the Nigerian rice sector to meet the domestic demand has raised a number of pertinent questions both in policy circle and among researchers. For example what are the factors explaining why domestic production lags behind the demand for the commodity in Nigerian? Central to this explanation may likely be the issue of efficiency of the rice farmers in the use of resources (Okoruwa and Ogundele, 2006).

The efficiency with which farmers use available resources and improved technologies is important in agricultural production, more so that the demand for food crops is increasing due to population increase. In order to improve the lots of small-scale farmers in Nigeria, Omotesho, *et al.* (1997) suggested that the Government should assist them with new inputs, agricultural education, financial assistance and competent guidance in farm planning. These they

noted will help in possible reduction of the production cost, thereby leading to increased resource productivity and more efficient use of available farm resources.

This plausible suggestion necessitated the desire to see how far the Kwara State Government's assistance had gone in improving the technical efficiency of the rice farms at a government intervention site relative to that of other surrounding non-project farms located in the same vicinity. (Kwara State Ministry of Agriculture 2004). Research work of this nature can therefore play pivotal roles in the search for improvements in agricultural productivity in Nigeria.

2. Research Methodology

The study area was Kwara State. Kwara State was created in May 1967. It comprises of 16 Local Government Areas with a population estimate of about 2.3 million people (2006 census). The State shares boundaries with Oyo, Ondo and Osun to the South, Kebbi and Niger to the North, Kogi to the East and Republic of Benin on the West side. The daily temperature ranges between 21^{o}C to 33^{o}C. The state has two distinct climate seasons, the wet (Rainy) and the Dry (Harmattan) seasons (KWARA Ministry of Agriculture 2004).

This study was conducted in Patigi Local Government Areas, in the ecological zone B of the state. Patigi LGA and the adjoining Local Government Area, Edu, are the major rice producing areas of the state. The geographical location of these rice producing areas fall within the latitudes 8^{o} 30 - 9^{o} 00N and longitudes 5^{o}00 – 6^{o} 20E. Rice production is much favoured in this North Eastern part of the state as a result of the natural fertile land of the flood plains of the River Niger that stretches from Jebba/Bacita through Shonga in Edu to Gakpon in Patigi Local Government Areas of the state. The vegetation in the northern parts of Kwara State, of which Patigi Local Government Areas is one, is Savannah grass land while to the southern flanks are wooded guinea savannah. There exist in the study area an intermingling of loamy, clay and sandy soil. All the aforementioned allied with good climate conditions and farmers experience have combined to place Kwara State in a very much competitive position and advantage in rice production with other rice producing states in the country (Kwara State Ministry of Agriculture 2004).

The data used in this study were obtained from both primary and secondary sources of information. Information related to primary data were sourced through the help of KWADP Enumerators with the aid of interview schedules. Secondary data were obtained via excerpts from newspapers, photograph, journals, the Internet, the planning, monitoring and evaluation (PME) department of KWADP, the State and Federal Ministries of Agriculture. The data collected was based on the 2005 dry and 2006 wet cropping season. The data collected covered the socio-economic characteristics of selected farmers, agricultural production and other economic indicator variables. Socio –economic and demographic data collected include those of age, experience, gender, household size, educational status, source of credit facility, while agricultural data included farm size, access to farm inputs, labour utilization among other factors.

Of note to this study is the Duku river basin, which also happens to be the site of an irrigation facility. At this location exists a group of rice farms that enjoy various forms of government assistance. The Duku/Lade 800ha irrigation scheme is Kwara State's premier irrigation project, which came into being in the year 1959 for the supply of supplementary irrigation water. The irrigation scheme, which had been moribund for close to 20 years, recently received the attention of the state Government through the rehabilitation of its reservoir, approach channel, canals and the entire rice farm site. The headwork capacity is estimated at about 38.63M^{2}/Sec. (Kwara State Ministry of Agriculture, 2004). However, investigations revealed that the headwork at the irrigation site collapsed barely year after its rehabilitation. The recently re-dredged river Duku has also silted up, thereby hindering the free flow of water into the channels. So for farms at the project site, the irrigation facility was only accessed during the 2005 dry season rice cropping. However the existing water channels serve the farmers well during the wet season. At this time the river swells up and the excess water flows over, into the channels that run across the length and breadth of the project site farms. About 600 farm families at the site are currently believed to be enjoying government assistance, particularly in the areas of subsidized inputs. The estimated populations of the villages in and around the project area are presented in Table 2.

3.1 Sampling Procedures:

(i) Project Site: -

Benefiting directly from the Duku-Lade Government assisted farm site are some 600 Farm Families. For the purpose of this study the 600 Farm Families formed the sampling frame out of which a random selection of 12% i.e. 72 Farm Families was made. Each farm family in the sampling frame was

assigned a number, and then 72 farm families were chosen using a table of random numbers and eventually only 62 farm families responded (see Table 2**).**

(ii) Non – Project site

Adjoining the project site are four villages not benefiting from Duku Lade Irrigation Scheme. The Farm Families around this area are estimated at about 380 Farm Families. Out of this sampling frame of 380 Farm Families, a random selection of 12% i.e. 46 Farm Families was done and eventually only 38 responded (see Table 2).

Table 1: NOTABLE VILLAGES IN THE DUKU LADE RIVER BASIN

S/NO	Name of Town or Village	Approximate Population	REMARKS
1	Lade	16,500	GOVERNMENT ASSISTEDPROJECT SITES FARMS
2	Edogi Rete	5,000	”
3	Sakpefu	10,000	”
4	Bissan	100	”
5	Gberi	53	”
6	Chenegi	6,000	”
7	Rami	5,000	NON-PROJECT FARM SITES
8	Edogi Chapa	7,000	”
9	Gbangede	550	”
10	Sanganuwon	250	”

Source: (Kwara State Ministry of Agriculture, 2004)

The unit of analysis in this study is the farm family and information was drawn from the farm families.

TABLE 2: SAMPLING DISTRIBUTION OF THE STUDY AREA

	LGA	Farm Sites	Farm Families	Sample Farm families Used
1	Patigi	Project Site	600	62
2	Patigi	Non-Project Farm Site	380	38
Total			980	100

Source: field survey, 2007

3.2 Analytical Techniques

The analytical techniques employed in the study include: Descriptive Statistics, Farm budget analysis and stochastic frontier.

Farm Budget Analysis

Partial budget analysis was employed to determine Net Farm Income (NFI) and the Returns to Farmer’s Labour per hectare derived from rice production in the study area. The model for estimating the farmer’s returns to labour and management is outlined thus:

Gross Margin (TVC) = Gross Value Output (TR) -Total Variable Cost of Production (1)

Net farm income = Gross Margin - Fixed cost (2)

Returns to Farmer’s Labour and Management Net= Farm income - Imputed cost of Family labour (3)

Returns to Farmer’s Labour and management/Net Farm Income are the focal point for the costs and returns analysis of this study.

Rate of return (ROR) provides a measure of financial performance of the enterprise employed expressed in percentage (%) (i.e. profit/ ₦ invested).

3.3 Stochastic Frontier Functions

The stochastic production frontier model was also used. Since stochastic frontier production models proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and vanden-Broeck (1977), there has been a vast range of their applications in literature. Battese and Coelli (1995) proposed a stochastic production function, which has firm’s effects as a truncated normal random variable, in which the inefficiency effects are directly influenced by a number of variables. The generalized stochastic frontier model can be expressed for the rice farm sites as:

$$Q = f(X_I, X_2, X_3, X_4, X_5, X_6, X_7) \quad (4)$$

Applying the Cobb-Douglas production function

$$\ln Q_{ip} = ß_0 + ß_1 \ln (X_{1p}) + ß_2 \ln (X_{2p}) + ß_3 \ln (X_{3p}) + \beta_4 \ln (X_{4p}) + \beta_5 \ln(X_{5p}) + \beta_6 (X_{6p}) + \beta_7 \ln (X_{7p}) + (V_{ip} - U_{ip}) \quad (5)$$

and

$$\ln Q_{in} = ß_0 + ß_1 \ln (X_{1np}) + ß_2 \ln (X_{2np}) + ß_3 \ln (X_{3np}) + \beta_4 \ln(X_{4np}) + \beta_5 \ln(X_{5np}) + \beta_6(X_{6np}) + \beta_7 \ln(X_{7np}) + (V_{i\,np} - U_{inp}) \quad (6)$$

Where:

(i_p =1…62 and i_{np}= 1… 38);

Q = Output in kg; X_1 = land (Ha); X_2 = Labour in Man-day X_3 = Fertilizer (Kg); X_4 = Seeds (Kg); X_5 = agrochemicals (Litres); X_6 = Equipment (number); X_7 = Tractor usage (machine day); In = Natural Logarithm (i.e. Log to base e); $ß_I$’s= unknown Parameters to be estimated.

According to Aigner, Lovell and Schmidt (1977), the error term is really a composite of two terms: $\varepsilon = V_i - U_i; i=1,\ldots,n$ - (7)

Where Vi represents random variables that are assumed to be normally distributed N (o, δ_v^2) and independent of the U_i. It is assumed to account for measurement error and other factors not under the control of the farmer. Vi is the two-sided normally distributed random error [(V~N (o,σ^2)].

U_i represents non-negative random variables called technical inefficiency effects which are assumed to account for technical inefficiency in production and are often assumed to be normally distributed N ~ (0, δ_u^2). Ui is the one-sided efficiency component with a half normal distribution U~[N (o, σ^2)].

Knowing that firms are technically inefficiency might not be useful unless the sources of the inefficiency are identified (Admassie and Matambalya, 2002). Thus, the second stage of this analysis investigates the sources of the farm level technical inefficiency for the project.

The inefficiency model for the two study sites are assumed thus:

$U_{ip} = d_{op} + d_1Z_{1p} + d_2Z_p + d_3Z_p$ (8)

and

$U_{inp} = d_{onp} + d_1Z_{1np} + d_2Z_{2np} + d_3Z_{np}$ (9)

Where: U_i = Technical inefficiency; Z_1 = Years of experience of farmers (years); Z_2 = Level of education (years); Z_3 = Household size; Z_4 = Access to irrigation site (Yes = 1, No = 0); Z_5 = Access to former credit (Yes = 1, No = 0); Z_6 = Membership of cooperative association (Yes = 1, No = 0)

The maximum likelihood estimates will be adopted because according to Coelli (1995), it is asymptotically more efficient than the corrected ordinary least square estimates. The maximum likelihood estimates for all the parameters of the stochastic frontier and inefficiency model, defined by equation (1) and 2 will be simultaneously obtained by using the program, FRONTIER VERSION 4.1. (Coelli, 1996) which estimates the variance parameters in terms of the parameterization.

$\delta^2 = \delta V^2 + \delta U^2$ (10)

and $\gamma = \dfrac{\delta U^2}{\delta V^2 + \delta U^2}$ (11)

Where gamma (γ) = total output attained on the frontiers which is attributed to technical efficiency. Hence, it is a measure of technical efficiency. The technical efficiency of a farmer is between 0 and 1 (Battese an Coelli, 1995) and is inversely related to the level of the technical inefficiency effect.

Similarly, (I – Y) measure the technical inefficiency of the farms. The estimated Lambda (λ) is expected to be greater than one. Such a result indicates a good fit for the model and the correctness of the specified distribution assumption for V_i an U_i.

3. Results and discussion

Analysis on age reveals that, at the project site, the modal age group is 31 – 40 years with 58% of the 62 respondents in this age group. The mean age of the resource users is 35.5years. As in the project site, the modal age group for those in the non-project was between 31 – 40years, which constitute about 60% of the respondent. The mean age of the non -project group incidentally is also 35.5years.

The modal group of family size is 1 – 5 persons at the project site, which constitutes 51%. On the other hand 50% of respondents at the non-project site, have a family size of 6 to 10 persons, indicating a larger family size at the non-project site. The average size of farm family at the project site is about 3 persons, while that at the non-project site is 6. Probably because of the harsh economic environment, most families have kept low the number of children and thereby having smaller family size. Hence there is more recourse to tractor usage to augment family labour.

About 50% of the respondents at the non project site possess no formal education. In comparison, 33% at the project site also have no form of formal education. In order to meet up with the challenges of the low literacy level of the farmers, particularly at the non-project sites, the Kwara ADP extends knowledge support through extension agents. How effective are these extension agents in advancing their knowledge is one question begging for an answer; but then a way must be found to improve the frontiers of knowledge of these illiterate farmers, if their efficiency of production is to be enhanced.

A typical farmer at the project site had 15years of experience in farming while that of the non-project site had 25years. The farmers at the project site indicated that they have been involved at the project site over the 2005 and 2006 farming season. The project came into being in the year 2005. The modal class for farming experience in the project site is 11 – 20 years while that at the non-project site is 21 – 30 years. This is an indication that the farmers at the project site are much younger and have lesser years of farming experience farming than those at the non-project site.

Virtually all respondents at both the project and non-project site belong to one form of socio-economic organization or the other. Cooperative Organization affords members the advantage of benefits accruing to members. This was evident in the case of project

sites farmer who have to belong to a cooperative organization before they could be accessing benefit of project farms, which in somewhat affected their technical efficiency of production positively.

Of the 62 respondents at the project sites 82.26% belong to agricultural cooperative societies respectively. On the other hand, of the 38 respondents at the non-project sites, 34.21% and 5.26% respectively belong to Religious/Traditional and agricultural cooperative societies.

Virtually all the farmers interviewed at the two study sites reported that decisions, during organizational meetings, are usually taken on collective basis. Such decisions arrived at, they also affirmed, are executed on individual basis. One of the conditionality for accessing government's benefits is being a member of a cooperative society and this must have been responsible for the higher percentage of farmers at the project site being members of one cooperative society or the other. Religious considerations must have inhibited farmers at the non-project site from being members of cooperatives as more of them are to be found in religious organization only.

All the farmers at the project site where allocated land under the government scheme at the Duku Lade River basin. On the other hand, 98% of farmers at the non-project site secured their farmlands through inheritance. Families probably due to strong personal attachment do not normally sell Land in the area.

At the project site, those farmers who had the opportunity to participate in the 2005 dry season and 2006 wet season farming had the benefit of 1 hectare of land allotted to them per each season (thus amounting to 2 hectares each). In the case of the non-project site farmers they could only participate in the 2006 farming season only and the mean farm size was1.5 ha. Incidentally the mean farm size at the project site was also 1.5 ha as well.

Except for a farmer, other respondents at the project site indicated that there was no conflicts whatsoever, in land use. On the other hand, 26.32% of farmers at the non-project site acknowledged the existence of conflicts with the Fulani cattle herders.

Interaction with farmers at the study sites revealed that the destruction of their rice farms by the Fulani's' cattle herds was the main source of conflict. They also indicated the re-sought to village heads and police to resolve these conflicts. No doubt, the havoc at the non-project site farms was partly responsible for the lower income of the farmers at the non-project site when compared to that of the project site farmers. If not for the protection enjoyed by farmers at the project site they might as well be affected by the menace of the Fulani's cattle herds.

Probably as a result of intensive rice cultivation most of the farmers at both farm locations employed the use of tractor in addition to human labour in their farming operations.

All the 62 respondents at the project site indicated that they employed both human labour and tractor in land preparation and other farm operations. On the other hand, 84.21% of the 38 respondents at the non-project site said they do employ the both human labour and tractor, while the rest 15.79% indicated that they employed human labour only. It should be noted that farmers who employed human labour only, in actual fact undertook zero tillage as a means of avoiding the cost of tractor usage which appears to expensive for them. Zero tillage also has the advantage of the soil being preserved in its natural state.

Virtually all the farmers at both project and non-project site undertook sole rice cropping.

Sole rice production, without a considerable yield per hectare makes profit maximization un-attainable in the study sites.

Both site farmers also employ the use of machinery in their farming operations. While virtually all farmers at the project site source their tillage machinery from government agencies, those at the non- project sites sourced theirs from both government private sources. In cases where it sourced from private agencies, it was observed the cost of equipment rentage brought down the net farm income.

Capital is an important factor in farming enterprise. This study revealed that 90% of the 62 respondents at the project site got their capital through the State Government guaranteed Commercial Bank Loan (United Bank for Africa PLC). According to the findings, a flat rate of ₦70.000 was given to each farmer as interest-free loan at the project site. This amount was not directly availed to them in cash form, but was rather given out as inputs such as fertilizer, improved rice seeds, agro-chemicals and tractor use. Conversely, 80% of the 38 respondents at the non-project site claimed to have sourced their capital from friends and relatives. From the findings, the average amount received as loan from these informal sources is ₦20, 000.00.

One would have thought some of the farmers at both farm sites would have enjoyed some credit facility from the Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB), but none did. The reason given was that they had no collateral to secure the bank's lending. For those who could afford some form of collateral, they claimed the

procedures involved in securing these credits are too lengthy and time wasting.

TABLE 3: Distribution of Respondents according to Source of Credit

Source of Capital for Farming	Project Site		Non Project Site	
	Freq	(%)	Freq	(%)
Credit from Formal (government guaranteed bank loan) /Income Generated from Enterprises	60	96.77	6	15.79
Credit from Informal (friends & relatives) /income generated			32	84.21
Personal Income Generated from Enterprises	-		-	
Credit from Formal Sources (government guaranteed bank loan) Credit/Informal Sources (friends & relatives)	2	3.23	-	
Total	62	100	38	100

Source: Field Survey, 2007.

Importance of agro of inputs like agrochemicals, seeds, fertilizer and other purchased inputs cannot be over emphasized in agricultural production. Therefore, it will be necessary for farmers to have ready access to these inputs and at an affordable price. The study revealed close to 100% of the 62 respondents at the project site enjoy Government support in the area of land preparation, input procurement, farm produce, marketing, crop management and extension service/training provision. On the other hand, 100% of the 38 farmers in the non-project site reported that, except in the area of extension service/training, they do not enjoy the support of government agencies. An examination of table 4 indicated that the project site farmers' had far better access to government assistance and this could possible explain the higher production rate and the consequent higher net farm income achieved by them.

Table 4: Distribution of Respondents according to Institutional Assistance:

Form of Intervention	Project Site		Non Project Site	
	Freq.	(%)	Freq.	(%)
Assistance in Inputs Procurement	58	94	7	19
Assistance in Land Preparation	58	94	6	16
Assistance in Marketing Farm Produce	58	94	7	19
Assistance in Evacuating Farm	50	81	6	16
Assistance in Crop/Farm Management	57	92	6	16
Provision of Extension/Training Service	61	99	24	64
Provision of Infrastructural Facilities	3	5	1	3
All of the Above	1	2	-	-

Source: Field Survey, 2007.

It is also worthy to note the irrigation scheme site which was rehabilitated for a use in the 2005 dry season cropping was of no use during the 2006 dry season, as a result of the collapse of headwork and silting up of the river channels.

Of the 62 respondents at the project site, 100% indicated that they do benefit water supply for crop use under the Duku-Lade Irrigation scheme, as against the indirect water benefit claim of 73.68% of the 38 respondents in the adjoining non-project sites. That is to say 76.32% of these farms, adjoining the scheme site, depend solely on the annual rainfall regime for their crop water usage (Table 5).

Where applicable, the system of irrigation is of the basin-gravity type, whereby water flooded on to the field sinks directly into the soil for crop usage.

Table 5: Distribution of Respondents according to Water Source

Water source	Project Site		Non Project Site	
	Freq.	(%)	Freq.	(%)
Rain Fed up land	58	93.54	29	76.32
Rain fed lowland (Water Logged)	-		-	
Small Pump Assisted	-		-	
Dry season Irrigation	2	3.23	2	5.26
Rain fed lowland/dry season Irrigation	2	3.23	7	18.42
Total	62	100	38	100

Source: Field Survey, 2007.

3.1 Analysis of output variation / marketing factors.

The study revealed that about 82% of project sites indicated that planting/harvesting are scheduled at agreed periods. Contrarily, 92% of the farmers at non-project site indicated that each farmer in the area does planting almost simultaneously, however harvesting period varies from farmer to farmer. The usual planting time of rice is around June/July, while harvesting time is around four to five months to planting date, depending on the variety of planted. Farmers at both site locations perceived ecological factors as a main constraint to production. Fluctuating rainfall pattern is one main ecological factor pointed to by both groups.

The summary related to variables used for analysis for both project and non-project sites are depicted in table 6. The means of the inputs presented in Table 6, suggest that at the time of survey, non-project farmers lagged behind, in output and in the area of fertilizer.

The project site farmers used more fertilizer due to its ready availability to them (through the Government Assisted Scheme). In spite of the employment of tractor in farming operations, the use of human labour was still high at both study sites. This was probably due to the extra labour hours employed in bird scaring in rice paddy farms; and as such extra labour is required, and often, at a high cost.

The mean of input seed used was almost same for the two sites. One would have thought that with the improved variety of seeds employed at the project site, it would have implied the quantity of seed input would be lesser than that obtainable at non-project site. Perhaps the so-called improved variety employed at the project site might no be that improved as to produce higher yields per hectare. Table 7 shows that the mean level output 2,825.70kg per hectare is for project site more than the 1,506.86kg for the non-project site.

Table 6: Summary Statistics of input and output

Variable	Measure	Project Site		Non Project Site	
		Mean	STD	Mean	STD
Output	Tonnes	2825.7	721.26	1506.86	496.03
Family Labour	Manday	89.14	31.71	85.49	23.46
Seeds	Kg.	48.74	5.37	51.56	16.15
Fertilizers	Kg.	297.31	18.26	170.96	59.08
Herbicides	litre	0.99	0.04	0.8	1.95
Equipment	No.	23.76	9.45	20.22	7.21
Machine Use	Man days	0.77	0.15	0.78	0.07

Source: Field Survey, 2007.

3.2 Analysis of Costs and Returns to Rice Production.

The Capital cost is the depreciated value of farm, implements. According to Olubiyo and Adewumi (1997), giving two farms of varying degree of technical (and price) efficiency, facing identical output prices, the farm with the higher profits with a certain range is said to be relatively more economically efficient. Going by this submission, the Net Farm Income per hectare of land cultivated was adopted as a measure of economic efficiency for the two farm sites. Therefore, with gross margin of ₦94, 376.35 appear to be more economically efficient when compared to the non-project site with a gross margin of ₦ 29,515.33. The rate of returns to rice production at the project and non-project sites was estimated at 88.8% and 36.06% respectively, which indicate that for every ₦ 1 invested in each of the sites ₦ 0.88k and ₦ 0.36k was expected as profit respectively.

Table 7: Summary of Costs and Returns to Production of One Hectare of Rice at the Two Sites

Variable	Measure	Project Site
		Mean
Labour in-put (ha)	89.14 man-day	85.49 man-day
Gross Income/ha	**197,798.92**	**105,480.48**
Less TVC:		
Labour Cost (₦)	56,618.55	37,458.97
Seed (₦)	4,873.66	4124.56
Fertilizer (₦)	14,449.35	9,368.88
Herbicides (₦)	994.62	930.50
Machine Cost (₦)	26,486.49	24,082.24
Total Variable Cost (₦)	**103,422.67**	**78,900.66**
Equals Gross Margin (₦)	**94,376.25**	**29,515.33**
Less Fixed Cost (₦)	2,907.61	2,935.51
Equals Net Farm Income (₦)	**91,468.64**	**26,579.82**
Less Imputed Farmer's Family Labour	56,618.55	37,458.97
Returns to Farmer's Labour & Management	**38,850.09**	**-10,879.15**

Source: Field Survey, 2007.

3.3 Determinants of Technical Efficiency

The statistics gamma (γ) obtained from the estimated MLE model had values of 0.62 and 0.99 at 5% significant level for the project site and non-project sites respectively.

The results of the estimated maximum livelihood coefficient for both seeds and herbicides/pesticides (Agrochemical inputs) indicate positive value of 1.498 for seeds, 4.551 for chemical inputs in project sites and both were significant at 5% level. Consequently, an increment of the seeds for project site by one percent will increase output by 1.498 percent However this is opposite for non project site since the estimated maximum likelihood coefficient is negative value. Perhaps, the access to improved rice varieties must have led to the obvious higher yield per hectare of rice cultivated at the project site. This result is consistent with that of Okoruwa and Ogundele (2006) which indicated quality of seed planted was more important than absolute quantity.

TABLE 8: THE FINALE MLE ESTIMATES FOR THE TWO SITES

Site	Variable	Param.	Coeff.	S.E.	t-Ratio
PROJECT	Constant	β_0	9.447**	0.886	10.654
	Land	β_1	-4.887**	0.812	6.018
	Labour	β_2	-0.510**	0.239	-2.133
	Seeds	β_3	1.498**	0.248	6.037
	Fertilizer	β_4	-2.916**	0.496	-5.883
	Agrochemicals	β_5	4.551**	0.583	7.809
	Equipments	β_6	0.060	0.089	0.675
	Machine	β_7	2.296**	0.290	7.914
NONPROJECT	Constant	β_0	6.113	0.095	64.678
	Land	β_1	0.075	0.256	0.291
	Labour	β_2	-1.234	0.142	-8.705
	Seeds	β_3	-0.114	0.041	-2.809
	Fertilizer	β_4	0.162**	0.048	3.368
	Agrochemicals	β_5	-0.454**	0.098	4.631
	Equipments	β_6	-0.447	0.056	8.043
	Machine	β_7	0.244	0.227	1.077

Note: Significance Level of 5% and 10% are indicated by ** and * respectively.
Source: Field Survey 2007

The study also found out an incremental of the chemical inputs (herbicides/pesticides) for project sites will increase output by 4.551 percent. Moreso, land and fertilizer on non-project site indicate significant positive values of 0.075 and 0.162 respectively at 5% level. The study also revealed that machine use in project sites has significant positive value of 7.914% increment in output, suggesting the project site farmers patronize the use of machine more than the non-project site. Contrarily, the estimated MLE coefficient of land, labour and fertilizer in project sites and equipment in non-project site showed significant negative values of –6.018, -2.133, -5.883 and –8.043 respectively. This indicate an inverse relationship between the inputs and the output obtained i.e. an increment of the input by 1% will reduce the total output by their corresponding values in percentages. Also, akin to the findings of Okoruwa and Ogundele (2006) is the realization that over utilization of labour and fertilizer input did not suggest that increased uses of these inputs would yield more than proportionate increase in output.

3.4 Determinants of Technical Inefficiency

The coefficient of years of experience for project site farms had positive value and significant at 5% level, which indicates a non-correlation between the

years of experience and the production activities. The non-project sites indicate a significant but negative value for the year of experience at 5% level. This shows that the more experienced the non-project farmers are, the more efficient they become in their production activities and the more the output.

TABLE 9: DETERMINANTS OF TECHNICAL INEFFICIENCY

Site	Variable	Param.	Coeff.	S.E.	Ratio
PROJECT	Constant	Δ_0	-0.019	0.818	-0.023
	Experience	Δ_1	0.020**	0.008	2.407
	Education	Δ_2	-0.290*	0.177	-1.638
	Household	Δ_3	-0.027	0.022	-1.235
	Access to Project site	Δ_4	-0.240**	0.070	-3.406
	Credit	Δ_5	-0.019	0.818	-0.023
	Cooperative	Δ_6	-0.019	0.818	-0.023
	δ^2		0.014**	0.004	3.261
	γ		0.617**	0.112	5.476
	Log Likelihood Function		71.729		
NONPROJECT	Constant	Δ_0	0.392**	0.058	6.714
	Experience	Δ_1	-0.007*	0.003	-2.178
	Education	Δ_2	-0.123**	0.006	-18.942
	Household	Δ_3	0.003	0.005	0.580
	Access to Project site	Δ_4	-0.185	0.009	-21.169
	Credit	Δ_5	-0.011	0.042	-0.270
	Cooperative	Δ_6	-0.016	0.015	-1.073
	δ^2		0.003**	0.001	4.725
	γ		0.999**	0.002	619.039
	Log Likelihood Function		64.462		

Note: Significance Level of 5% and 10% are indicated by ** and * respectively.

Source: Field Survey, 2007

The level of education coefficient showed negative but significant value at 5% level for both project and non-project sites, therefore, the more education the farmers had, the more efficient they become and the higher the production efficiency. This result is consistent with the idea that schooling increases information and together with long run it experience leads to higher production (Dey, (2000), Basnayake Gunaratne, 2002; Msuya and Ashimogo, 2006).

The sign of the coefficient of age of the household heads was negative for the much younger project site farmers. This shows that the household head probably, require, also a more sophisticated physical skill, like that of the old farmers at the non-project site whose age co-efficient was positive. This observation finds support from other literature, which showed age to have a negative relationship with inefficiency and positive with efficiency (Dey, 2000, Admassie and Matambalya 2002). This shows that the head of the households at non-project site whose ages are higher might be unwilling to embrace better agricultural production practices.

The dummy variables for access to project site in both project and non-project sites were negative and significant at 5% level indicating that access to project could increase output level by virtue of the incentives given by the government.

The access to credit variable is expected to have a negative effect on the efficiency and so its coefficient, expected to have a positive value, hence the negative values for the variables obtained both at project and non-project sites has a positive effect on technical efficiency. Though, lack of access to credit may deprive the farmer from the purchase of inputs to increase efficiency. The coefficient of the dummy variable for access to co-operative association was negative in both project an non project sites indicating that the more farmers have access to co-operative the more informed they are and the more efficient they become in their production tasks.

Table 10: Range of technical efficiency for rice farmers at the two sites.

Efficiency Range	Project Site		Non Project Site	
	Freq.	(%)	Freq.	(%)
0.60 – 0.70	-	-	9	23.7
0.71 – 0.80	-	-	13	34.2
0.71 – 0.90	-	-	16	42.1
0.91 – 1.0	62	100	-	-
Total	62	100	38	100.0

Source: Field Survey, 2007.

A comparative analysis of the mean technical efficiency of 0.98 and 0.88 estimated for the project and non-project rice farms show that the differential of 0.1 exists between the two groups. This means that project site farms are 10% more technically efficient than the non-project ones and this conforms to a priori expectations. The higher efficiency estimate obtained for the rice farms at the project site can be attributed to the government support to the farmers in the form of input/output linkages.

4. CONCLUSION

The study revealed that there are more people in

the family in the non-project site than the project sites. The respondents in the project site are more educated than the non-project site registered higher numbers of illiterate and are more experienced than their project farmers.

Majority of the respondent in the project sites belong to the co-operative organization unlike those at the non-project site. The major source of capital of the farmers in the project site was through the state government guaranteed commercial bank loan while most of the farmer in the non-project site obtained theirs from friends and relatives and personal income. The study also revealed that majority of the farmers in the project site received various assistances, while the non-project counterpart only benefited in the extension training services. Virtually all the farmers in the project sites hired their tillage equipment from the government while the farmers in the non-project hired from publicly or privately sources. The farmers in the project sites obtained their farm inputs in form of the kinds from government and through personal income. While the non-project site farmers purchased their inputs with credit sourced from informal sources or personal income.

The result of the farm budget analysis for both the project and the non-project site revealed that farms from the project sites are more profitable and the rate of returns (ROR) to rice production showed that the ROR is higher for the project sites. The result of the estimated maximum likelihood coefficient indicates that seed agrochemical in sites, labour and fertilizer in non-project site and machine in project sites, showed significant positive value at 5% level. Thus a 1% increment in these input will increased output by their corresponding coefficient in percentage. The outcome of the determinant of technical inefficiency showed that education, access to project and co-operative in both project sites, experiences in non-project sites and age in project sites had significant negative value at 5% significant level. Thus have positive effect on the technical efficiency of the farms.

5. RECOMMENDATIONS

Consequent upon the findings of this study, the following recommendations are therefore suggested.

5.1 Access to Vital Inputs at Affordable Price: -

Given to the significance of fertilizer and improved High Yielding Cultivars (HYC) at both study sites, it is important to design policy framework that will ensure the sustainable provision of these two inputs so as to enhance efficiency and competitiveness in production. Government should create a support system by the establishment of a number of one-stop shops at convenient locations; so that farmers can easily access fertilizer and other farm inputs. If possible, these inputs should be supplied at subsidized rate. After all, the American Governments that have always called for removal of farm subsidy once distributed a record of $28 Billion in direct payments to farmers, accounting for nearly 50% of all the money made by American Farmers in the year 2000. In eight states of the American Nation, this made up 100% of total farm income, according to the New York Times (Tax Payer. net, 2001). The justification of the American Government's spending on agriculture was predicated upon the fact that certain factors can work against farmers success and that at times different factors could converge to push farms over the edge into failure, and pleas for help become particularly intense, thereby making it imperative for government no intervene. The government therefore, at such period when the farm economy goes down, usually responds with sweeping agricultural reforms, most notably a system of price support – subsidy as was the case in the years 1998 and 1999, when the US congress passed bailout laws that temporarily boosted farm subsidies the 1996 act tried to phase out. Subsides of $22,500 Million in 1999 actually set a new record for the injections into the American Farm Economy (http//usinfo.chapter8.htm).

It is therefore not out of place for governments in Nigeria to subsidize farm inputs, if production is to be increased. However, the technical efficiency indices will be estimated outside of the actual market price of farm inputs. For the Kwara State Government, that has been giving price-based-support to the New-Nigeria "Zimbabwe" Farmers, it will also be worthwhile if it gives some leverage to local farmers as well. What is good for the goose is also good for gander.

5.2 Improved Access to Micro-Credit:

Okunneye (1986) emphasized that agricultural growth requires increased government intervention. Therefore, it would not be out of place for government to assist small-scale farmers in the areas of credit. The Agricultural Credit Guarantee scheme as well as the loan giving Nigeria Agricultural Cooperative and Rural Development Bank (NACRB) are supposed to be the main channels for sourcing credit to farmers. However, it is necessary to fully harness the operation of these schemes to the advantage of these farmers. Emphasis should be placed on extending credit to cooperative based farmers so as to take advantage of chain guarantee when it comes to repayment of these loans.

5.3 Improved Access to Effective Extension/Advisory Services

There is appreciable level of extension contact with the farmers particularly at the project farm site, however much is still to be achieved with respect to the impact of these extension visit on the farmers.

There is therefore the need for a policy framework that will promote a more sustainable agricultural extension system as a veritable means of enhancing the technical efficiency of the rice farms at the Duku Lade River Basin. In essence bring in all rice farmers in the area into the realm of government-assisted projects. This is imperative, as it would enable farmers make informed decision particularly in allocating production inputs more efficiently, and thereby boost the current production of rice not only in Kwara State but also in Nigeria as a whole.

5.4 Placing Less Emphasis on Dry Season Irrigation Farming.

It is suggested that government should restructure its current position on the Dry Season Irrigation Projects to make it more efficient and effective. Considering the fact that large scale production during dry season cannot be easily sustained in terms of hecterage, water sourcing, sufficient farmer's participation, labour requirement for bird scaring etc., all the more calls for these restructuring. The small present cultivation level during the dry season, more often result in the problem of "farm isolation" thereby exposing these lonesome farms to vagaries of insects and other pest's devastations.

Therefore Government cannot but pay greater attention to rain fed rice farming. Through the provision of HYCs and other necessary farm inputs, the much desired increased production levels as well as efficiency of production can be attained. After all, in spite of the enormous amount expended on the existing Duku Lade Irrigation site facilities, it became non-functional barely one year after it's rehabilitation. So, funds should rather be channeled towards rain fed cropping season. The existing flood channel will still be useful, as basin irrigation is the main practice in place, both during the dry and raining season at the study site

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