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EVALUATION OF GENDER DIFFERENTIAL IN RESOURCE UTILIZATION AND ESTIMATION OF EFFICIENCY UNDER ACCELERATED RICE PRODUCTION PROGRAMME IN KOGI STATE, NIGERIA

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ABSTRACT

The study was carried out to evaluate numerically the gender differential of male and female rice farmers from the point of view of technical efficiency under accelerated rice production programme in Kogi State, Nigeria. A two stage systematic random sampling technique was used to select 216 irrigated rice farmers for this study. descriptive and inferential statistics were used to analyze the data. Primary data were collected using structured questionnaire administered to 151 males and 65 females during 2016 – 2017 production season. The results of the stochastic production function showed that estimated coefficients of seed and labour were significant at $p<0.01\%$ and $p<0.1$ for both male and female rice farmers. Fertilizer (-0.208) was negative and significant at $p<0.01\%$ for female farmers and insignificant to male farmers while agrochemicals was positive and significant at $p<0.01\%$ for male and insignificant for female. The mean technical efficiency was 0.79 and 0.64 for the male and female farmers respectively implying that male farmers are more efficient than their counterpart. The study concludes that, the yield level in rice production among male and female farmers can be increased if the use of major variable inputs such as labour, seed and fertilizer influencing the output could be increased to 21 and 36 %, respectively. Findings further revealed that none of the sampled rice farms reached the frontier threshold due to farmer's inefficiencies. This study recommends that since positive and significant relationship exist between seed and labour, the programme should train the farmers on use of productive resources and farm management skills which will enable the farmers to optimally utilize their variable inputs focusing on efficiency as their goal.

Keywords: Gender; Accelerated Rice production programme; technical efficiency; resource utilization

INTRODUCTION

Nigeria is an agrarian country with about 70 percent of the population engaged in agricultural production (Yusuf *et al*., 2016). Successive governments have made various

interventions in modernizing agriculture in Africa which was characterized by sluggish growth, low factor productivity, declining terms of trade, and often linked to practices that degrade the environment (Salama *et al.,* 2010). Past poverty reduction programmes had a marginal impact on productivity, rural livelihood and poverty despite large budgetary allocations and these programmes failed to achieve their objectives because of poor design (Abdulazeez *et al.*, 2018; Tomori *et al*., 2005). The Kogi Accelerated Rice Production Programme is an initiative of the Kogi State Government with its objectives tailored in line with the Agricultural Transformation Agenda of the Federal Government. The Kogi Accelarated Rice Production Programme (KARPP) which started in December 2011 aims to make the state self-sufficient in rice production with particular emphasis on irrigated rice production and create wealth for farmers through opportunities in rice processing and export.

The effort to increase rice production has been achieved largely through increase in the hectarage rather than using productivity-improving technologies (Ajewole *et al*., 2015; FAO, 1999). Within this rice production system, women have been reported to play a crucial role in farming, processing and marketing and it is estimated that over 60 percent of all agricultural production, processing and marketing activities were carried out by women (Yusuf, 2015). However, a body of empirical evidence from many different countries shows that female farmers are just as efficient as their male counterparts, but they have fewer resources, resulting in inadequate use of resources, limited alternatives and low income so they produce less (Yusuf, 2015). Women are a key stakeholder in agriculture, yet they face numerous formidable obstacles (Kandiwa, 2013). Ayinde *et al*. (2013a) opined that, it is of importance to have strategy to put men and women's concerns and experiences at the centre of research design, implementation, monitoring, and evaluation. Bridging the gap in access to technology between men and women, we could increase productivity; Ayinde *et.al*. (2013b) further affirmed that technological adoption among male and female farmers is crucial to improving the productivity in the face of climate change.

Gender has proven to be an essential variable for analyzing the roles, responsibilities, constraints, opportunities, incentives, costs and benefits in agriculture (Koyenikan, 2010). Gender relations are influenced by ethnic origin, age, religion, traditions, ideologies, societal perceptions as well as cultural and economic conditions. Gender gap is manifest in various facets of life. In agriculture, this include among others, access to and control of resources, as well as division of labour at the household level and among farming activities (Danso *et al*., 2004). Access to productive resources/inputs is an obstacle to agricultural growth in Africa, thus access to productive resources such as land, modern inputs, technology, education and financial services is a critical determinant of agricultural productivity (FAO, 2011). There is dearth of gender disaggregated research and documentation data in rice production under this programme. It is, therefore necessary to assess gender accessibility to resources among rice farmers under the programme; to establish benchmark for developing strategy for promoting gender equity in the accessibility to resources, involving rice farmers in the area. This becomes imperative to conduct this research to evaluation of gender differential in resource utilization and estimation of technical efficiency under accelerated rice production programme in Kogi State

MATERIALS AND METHODS

The Study Area

This study was conducted in Kogi State, North central part of Nigeria. The State has an area of 29,581.9 square kilometers with a projected population of 4.37 million by 2015 (Kogi State Government, 2007). Kogi State has an average maximum temperature of 33.2°C and average minimum of 22.8°C (Kogi State Government, 2007). The State has two distinct seasons – dry season, which lasts from November to February and the rainy season that lasts from March to October. Annual rainfall ranges from 1016 to 1524 mm (Kogi State Government, 2007).

The State is dissected by the two major rivers in Nigeria (Benue and Niger) as well as other rivers, streams and lakes/pond including man-made ones and this holds great potential for irrigation. The alluvial soil deposited along the banks of this River provides great opportunity for the cultivation of rice and other crops. In terms of rice production, reports by Horna *et al.* (2005) indicated that Kogi State produced at least 5% of the total rice production in Nigeria. According to Kogi State Ministry of Agriculture, the main rice producing areas in Kogi State are Ibaji, Idah, Lokoja and Bassa. As part of the drive to boost rice production, the State has established rice farms in Koto, Okumi, Galele and Sarkin Noma Irrigation Project sites. The State government has also embarked on the clearing of 6,750 hectares of land out of which 3, 000 hectares has already been cleared (by the year 2013), and 80 per cent of it had been cultivated as part of rice revolution in the State.

Sampling Procedure

This study employed a multi-stage sampling procedure in the selection of respondents for data collection. In the first stage, the two zones (Zone B & C) out of the four ADP zones in Kogi State were randomly selected through the use of card method. In the second stage, Bassa and Lokoja Local Governments were purposively selected each from Zone B and Zone C respectively based on the volume of rice cultivation and where irrigated rice production is currently taking place under the Kogi Accelerated Rice Production Programme (KARPP). The third stage involved listing of all the villages/communities in each of these two Local Government Areas (LGAs) mentioned above based on the intensity of irrigated rice production. On the basis of volume of irrigated rice production, Koriko 1 and Koriko 2 were selected from Bassa LGA and Kabawa, Sarkin Noma, Okumi 1 and Okumi 2 were selected from Lokoja LGA. In all, a total of six communities/villages were purposively selected from the two LGAs. Information obtained from the State ADP revealed that there were 287 registered farmers' cooperative groups, each comprising of 10 farmers as participants in the KARPP.

In the fourth stage, all the farmers' cooperative groups in the villages/communities selected were listed. From each of the communities/villages, 40% of the farmers' cooperative groups were selected randomly using ballot techniques thus giving a total of 48 farmers' cooperative groups. The last stage involves using a Slovian formula (adopted by Abdulrahman *et al.,* 2017) for calculating sample size based on the assumption of 5% expected margins of error, 95% confidence interval and applying the finite population correction factor. The formula is expressed as follows:

$$n_0 = \frac{N}{1+N(e^2)} \quad \text{---------- (1)}$$

Where: n_0 is the sample size without considering the finite population correction factor; e = 0.05; N = total number of observations. Therefore, 151 males and 65 females were drawn proportionate to the size, given a total of 216 irrigated rice farmers randomly selected using the card method and interviewed as participants in the Kogi Accelerated Rice Production Programme.

Data Collection and Analysis

The primary data were obtained by the use of structured questionnaire administered to rice farmers under accelerated rice production programme. Data collected were on labour, fertilizer, seed, agrochemical and farmer's socio-economic characteristics such as age, household size, educational status, amount of credit received, number of extension contacts and years spent on the cooperative, level of investment were also obtained.

Model Specification

The explicit form of the Technical Efficiency is as follows;
$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + V_i - U_i$
Where subscript i refer to the observation of ith farmers,
ln = Natural Logarithm,
Y_i = Output of the ith farmers (Kg)
X_1 = average quantity of seed (Kg)
X_2 = average quantity of fertilizer or manure (Kg)
X_3 = average man-days of labour (man-days)
X_4 = average agrochemical (L) (inorganic only)
Vi = random variability in the production that cannot be influenced by the farmer.
$-U_i$ = deviation from maximum potential output attributable to technically inefficiency.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Farmers

Table 1 revealed that irrigated rice farming household heads under Kogi accelerated rice production programme in the study area are dominated by married groups male (74%) and female (90%); average age of 42 years for male and 39 years for female respectively. The household size was adjusted using Organization for Economic Corporation and Development Scale (OECD). The result revealed that adjusted household size for male was 6.7 and 4.5 for female and female household members. This finding is in line with Mahabub and Jaim (2011) the average family size of male farmers' household was found to be 6 while it was 5 for the female farmers. Although, they observed that the family size of both female and male farmers' household was of not much difference. The estimated mean years of schooling of sampled farmers were 12.7 and 8.4 years for both sexes, though skewed towards the formal education and above United Nation Development Programme (2011) mean education index of 5 years for Nigeria. This finding is at variance with Olaleye *et al.* (2009)

revealed that 65% of the farmers in their study did not have formal education especially the women. The study also revealed that 60% of the male farmers had up to 8 years' experience and 74% of female farmers had 4 years in irrigated rice farming. The level of investment, area devoted for irrigated rice farming and average income rice output depict in Table 1 also revealed that the irrigated rice farming is still largely subsistence. Also, the low level of investment could stem from incentives provided by the government as an assistance in the form of provision of farm input like improved rice seeds, fertilizers, herbicides, etc. The State Government under the programme also provided farmers with pumping machines for irrigation, diesel for the machine, maintenance and supplementary labour. Farmers were also trained on irrigated rice production. Majority of farmers for both had no access to credit. This low access to credit could be attributed to the fact that government seldom grants financial credit to large numbers of farmers which is highly subsidized and seldom free. Indeed, the study noted that Kogi accelerated rice production programme does not give loan to participants; it only facilitates access to credits from commercial banks which they apply their rules and regulations guiding giving loan out to customers; which majority of the farmers in the study area cannot afford.

Table 1: The socio-economic characteristics of respondents

Variables	Unit	Male	Female
Marital status	Married=1 otherwise=0	74% were married	90% were married
Age	Years of schooling	46% below 50 years	42% below 40 years
Level of Education	Years	81% are literate	60% are literate
Farming experience	Years	60% had up to 10 years	53% had up to 13 years
Household size	Number	55% had 4-8 persons	55% had 4-8 persons
Level of investment	(₦)	70% invest< ₦120, 000	70% invest< ₦120, 000
Labour components	Years	61% used family labour	61% used family labour
Access to Credit	Access =1 otherwise=0	70% without credit	90% without credit

Stochastic Frontier Production Function

The maximum likelihood estimates of the parameters of the stochastic frontier model for male and female irrigated rice producers are presented in Table 2. The estimated sigma squared (σ2) was significantly different from zero (1.525) for male and (0.7603) for female rice farmers at the 1% level, implying that the model is an adequate representation of the data. The value of sigma squared ($\boldsymbol{\sigma^2}$) was significantly different from zero level of probability. This indicates a good fit and correctness of the specified distributional assumptions of the composite error terms. In addition, the estimated gamma parameter (γ) of 0.346 and 0.561 for male and female was significant at 1%, indicating that about 34% and 56% of the variation in actual output from maximum output (output frontier) among irrigated rice farms was due mainly to differences in farmers' practices rather than random variability.

The estimated coefficients of seeds were positive and statistically significant at p<0.01% for male irrigated rice farmers while for the female counterpart it was positive and statistically significant at p<0.1%. These implies a direct relationship between seed and output. However, a unit increase in seeds inputs will lead to increase of 0.988 kg and 0.151 kg of irrigated rice output for male and female farmers respectively. However, it is noticed

from the coefficients of gender, that male is more efficient in seed management compare to their counterpart. This finding is in line with Oladimeji and Abdulsalam, (2013) who observed seeds to be an important variable in determinants of rice and melon respectively.

The estimated coefficient of fertilizer was negative and insignificant for male and significant for female farmers at p<0.01% probability level. This implies that a p<0.01% increase in fertilizer will decrease rice output by 20.8% and 96% for both male and female respectively. Fertilizer is a major land augmenting input because it improves the quality of land by raising yields per hectare. This study is in agreement with the findings of Buniyu *et al*. (2016). Fertilizer is supposed to contribute significantly to rice production but high cost of this input adversely affects profitability of rice and vice versa. The negative sign of the coefficient of fertilizer was at variance with a priori expectation. This, not withstanding, fertilizer is an essential farm input, and one that is critical to rice cultivation.

The estimated parameter of agrochemical was positive and significant at p<0.01% level for male farmers but insignificant for female farmers. The implication of the result is that a unit increase in agrochemical to a certain level will increase the output of rice by 45percent. The sign was as expected because use of agrochemical reduces drudgery in farm operations such as weeding and clearing as well as increase quantity of output produced stemming from control of pests and diseases. This study is in agreement with the findings of Buniyu *et al*. (2016), who reported that agrochemical was positive and statistically not different from zero. This implies that an increase in agrochemical to a certain level will increase technical inefficiency by 19.7%.

Table 2: Production function

Variables	Male		Female	
Production Function	Coefficients	t-value	Coefficients	t-value
Constant	0.712 (0.938)	0.759^{ns}	-0.018 (0.031)	0.594 ^{ns}
Seed	0.988 (0.171)	5.778***	0.151 (0.090)	1.671*
Fertilizer	-0.208 (0.546)	-0.382 ^{ns}	-0.960 (0.277)	-3.465***
Agrochemical	0.455 (0.173)	2.630***	0.065 (0.172)	0.381 ^{ns}
Labour	0.715 (0.295)	2.423**	0.165 (0.091)	1.812*
Diagnostic Statistic				
Sigma-square	1.525		0.7603	
Gamma	0.346		0.006	
Log likelihood function	-48.035		-158.820	
LR test	17.805		12.99	
Mean efficiency	0.79		0.64	

Figures in parentheses are standard error, *** = p<0.01%, * = p<0.1%, ns = not significant

The coefficient of labour was positive and statistically significant at p<0.01% and p<0.1% level for male and female respectively. This shows that labour is an important variable in rice farming in the study area. However, the result shows that male (0.715) are more efficient than female (0.165) rice farmers in terms of labour resources. This is in line with Umoh (2006) and Abdulrahman *et al*. (2016) which show the importance of labour in farming, particularly in developing countries where mechanization is rare on small scale farms. In the study area, human power plays a crucial role in virtually all farming activities. This situation has variously been attributed to the practice of split-plot cropping on small scattered land holdings and lack of affordable equipment.

Technical Efficiency Estimates from the Stochastic Frontier Model

The distribution of technical efficiency score of male and female irrigated rice farmers in figure 1 ranged between 0.24 and 0.84 with average of 0.79 for male farmers. The average technical efficiency score of 0.79 implied that an average male rice farmer could increase output by 21% by improving technical efficiency in rice production while the female farmers ranged between 0.03 and 0.85 with average of 0.64 for female farmers. The average technical efficiency score of 0.61 implied that an average female rice farmer could increase output by 39% by improving technical efficiency in rice production. This result conformed to the findings of Rahman (2003), Oladimeji and Abdulsalam, (2013) and Abdulrahman *et al*. (2016), that reported mean technical efficiency levels of 0.77, 0.64 and 0.84 for Bangladeshi rice farmers, Kwara State Nigeria rice and melon vegetable farmers respectively.

The study also suggests that for the average farmer in the study area to achieve technical efficiency of his most efficient counterpart, he could realize about 22 percent (1-0.83/0.79*100) cost savings while on the other hand, the least technically efficient farmers will have about 90 percent (1-0.24/0.84*100) cost savings to become the most efficient male farmer while the female most efficient rice farmers will have 25% cost savings and 100% cost saving for least technically efficient female farmers. This finding is in line with Okoye, (2009) and Abdulrahman *et al*. (2016) who observed that average cocoyam farmer in the state would enjoy cost saving of about 32.9 and 20 percent if he or she attains the level of the most efficient farmer.

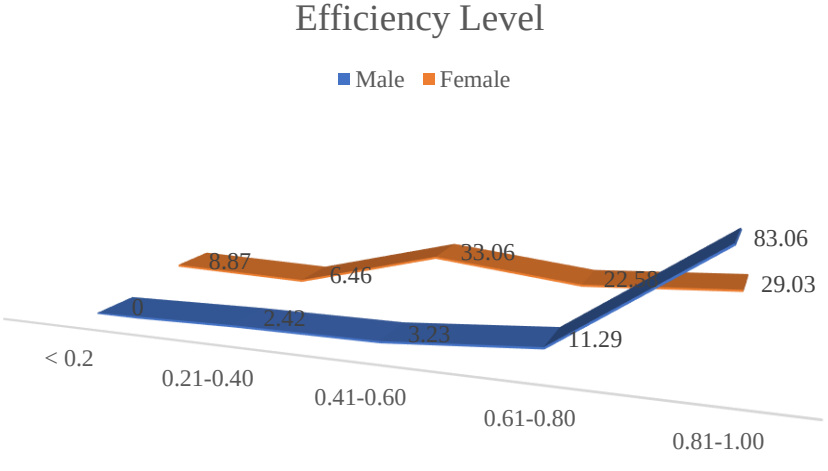

Figure 1: Distribution of male and female irrigated rice farmers efficiency

CONCLUSION

The paper evaluates gender differential in resource utilization and estimation of technical efficiency under accelerated rice production programme in Kogi State using the stochastic parametric method of estimation. The findings of the study revealed that male rice farmers had higher average technical efficiency and technical efficiency scores than their

female counterpart, although none of them attained the frontier threshold. The implication of the study is that technical efficiency in farm production among the farmers could be increased by 39% through better use of available resources given the current state of technology. It was therefore recommended that farmers should strive to adhere to good management practices. In addition, farmers should also follow recommended seed rate, trained on proper and efficient utilization of input resources such as seed, fertilizer, agrochemical and labour through cooperative in order to improve their technical efficiency.

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