PRODUCTIVITY OF GROUNDNUT FARMERS IN NIGER STATE, NIGERIA: GENDER DIFFERENTIAL ANALYSIS

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ABSTRACT

Poor productivity and gender disparities in agricultural production have hampered agro-industrial development and inclusive economic growth in Nigeria. The paper determined the productivity differentials in terms of efficiency estimates and scores, the scale of operation and the challenges faced by groundnut farmers along gender lines in the area. 132 groundnut farmers were randomly selected with, descriptive statistics and Data Envelopment Analysis (DEA) as analytical tools. Findings revealed that the farmers operated on a small-scale level. The mean efficiency estimates showed that female farmers (0.97) performed better than male farmers (0.94) under pure technical efficiency while male farmers were better under scale efficiency (0.93) than female farmers (0.89). The highest proportion of the farm groups was efficient under variable return to scale. The overall performance showed that female farm groups performed better in all three categories of efficiency measures than male groups. The analysis of the input slack revealed that 21 male groundnut farms and 10 female groundnut farms could reduce total expenditure on the farmland by 1.21% and 0.94%, respectively, without reducing their current level of production. Capital inputs, fertilizer, and seeds (male groups) and, capital inputs, farm size, and labour (female group) were the most excessively used inputs in the area. The major constraints facing the farmers were the unavailability of machinery for hire and the high cost of machinery. To scale up their productivity level, the farmers should be equipped with relevant and modern but subsidized production technologies through different intervention programs by the government and all the relevant stakeholders.

Keywords: DEA, Efficiency, Gender Differential, Groundnut, Small-scale

INTRODUCTION

Groundnut (*Arachis hypogaea L.*) originated from Latin America and belongs to the genius Arachis in the family Leguminosae (*Fabaceae*). It is a leguminous crop grown on 26.4 million hectares worldwide with a total production of 4,521,626.64 and 4,607,669.46 Tonnes in 2020 and 2021, respectively and an average yield of 10,977hg/ha and 10,786 hg/ha, respectively in the same period (FAOSTAT, 2023). Unlike other cereals and legumes, all parts of the plant are valuable. Its seeds are a rich source of oil (35–56%), protein (25–30%), carbohydrates (9.5–19.0%), minerals (P, Ca, Mg and K) and vitamins (E, K and B) (Abady *et al.*, 2019; Gulluoglu *et al.*, 2016). It is also used in crop rotational systems for soil fertility improvement and, industrially in the production of food, feed, paints, lubricants and insecticides (Jaiswal *et al*., 2017; Variath and Janila, 2017). Groundnut haulm can be used to supply feed to livestock and its hay can provide extra income to smallholder farmers The historic groundnut pyramids of Northern Nigeria and contributions of the crop to export revenue of Nigeria before the discovery of crude oil established an exceptional link between the crop and socio-cultural as well as economic growth of the country (Vabi *et al.*, 2019).

Agricultural productivity is at the centre of many of the debates, policies and measures concerning the farming sector. The emphasis placed by the Sustainable Development Goals on agricultural productivity underlines the many reasons why additional research on statistical frameworks for productivity targeted to developing countries, such as Nigeria, is necessary (FAO, 2017). This is because agricultural productivity is laden with many constraints among which are poor land tenure system, low level of irrigation farming, unreliable rainfall, traditional small-scale farming with little mechanization, increased and/or continued cultivation on marginal land, poor adoption of agronomic practices and limited extension services, land degradation problem, poor extension delivery system, high production cost, poor distribution of inputs, limited financing, high post-harvest losses and poor access to markets (Tsokar, 2019). Specifically, the productivity of groundnut farmers, in addition to the foregoing has suffered major setbacks from the groundnut rosette epidemics and foliar diseases, aflatoxin contamination and lack of sufficient and consistent supply of seed of improved varieties (Ajeigbe *et al.*, 2014; Vabi *et al.*, 2019). These challenges have hampered agricultural productivity in Nigeria, reduced agriculture's contribution to GDP and increased food imports due to population rise. The term 'Productivity' is simply defined as the rate of transformation of inputs to outputs in a farm firm. Gender plays a major role in this transformation process through land clearing, planting, weeding, chemical application, harvesting, processing, distribution, marketing and provision of other inputs. Nnaji *et al.* (2020) affirmed that gender relates to socially assigned roles and behaviours attributed to men and women which affects the distribution of resources, wealth, work, decision-making, political power as well as enjoyment and entitlements within the family, farm and public life.

Further, CCAFS & FAO (2012) opined that gender is a central organizing factor in societies and it can significantly affect the processes of production, consumption and distribution. Recent literature has also proven that, in Sub Sahara Africa (SSA), low agricultural productivity among farming households is driven by the overarching challenge of gender disparity in access, control, and utilization of production resources (Slavchevska, 2015; Oseni *et al*, 2015; Ali *et al.* 2016 & Muricho *et al*, 2020). This gendered disadvantage has led to a loss in agricultural share in the domestic, regional and international markets and has contributed to the persistent gender productivity gap in agriculture, which stands at not less than 20% (Mukasa and Salami, 2016; Muricho *et al.*, 2020). Therefore, rural development policies directed at the household may not have their intended effects unless there is a clear distinction in the role and position of gender in rural households.

In many countries of the world, gender differentials exist which places women in a subordinate position to men. Studies have shown that men and women engage in the production of groundnut and there is a presence of gender gap in agricultural productivity across Sub-Saharan Africa (Rahman, 2010; Mohammed *et al.*, 2014, Ali *et al.*, 2015; Mukasa and Salami, 2015). For instance, though women contribute about 50% of agricultural labor, structural barriers limit female farmers' productivity in the region (World Bank, 2014; Rufai *et al.*, 2018). Many literatures also affirmed that assuming both genders have the same agricultural production function and use the same technique for the same crop, land quality and crop choices as well as the quantity and quality of inputs applied may differ (Peterman *et al.*, 2010). Closing this gender productivity gap is critical to increasing agricultural production, cash incomes, reduction in poverty and improving the overall welfare of the farmers. It could also assist the female farmers to increase their productivity by 20–30% (Karamba and Winter, 2015; Kilic *et al.*, 2015), which in turn is likely to increase agricultural production in the region by between 2.5–4% and lift over 100 million people out of poverty (Rufai *et al.*, 2018).

Therefore, this study is aimed at assessing the gender-based productivity of groundnut farmers for possible inequality in the study area as well as the constraints to their optimum performance. This could allow for policy intervention through the introduction of novel farm practices that ensure efficient allocation of the existing resources, and supply of improved technologies as well as creating an enabling environment that fosters the increased productive capacity of both genders. It is against this backdrop that the study aimed at analyzing the gender productivity differentials of groundnut producers, their scale of operation as well as the constraints militating against the groundnut farmers in the area.

Measurement of Productivity

Productivity is the efficiency with which farm firms, organizations, industry, and the economy as a whole, convert inputs (labour, capital, and raw materials) into output. Productivity grows when output grows faster than inputs, which makes the existing inputs more productively efficient (PC, 2015). According to FAO (2017), farming systems in developing countries tend to be fairly diversified. Often, they combine crops and livestock activities and cash crops with subsistence activities. Proper accounting of the output of the farm, including secondary crops, by-products and unsold produce, is a prerequisite for obtaining an adequate measurement of productivity. The concept of efficiency measurement started with Farrel (1957) who proposed a division of the efficiency of a firm into technical and allocative efficiency. The combination of these two components results in economic efficiency (Oduol *et al.*, 2006; Yusuf and Malomo, 2007). The terms productivity and efficiency are often used interchangeably but these are not precisely the same thing. Productivity is an absolute concept and is measured by the ratio of output to inputs while efficiency is a relative concept and is measured by comparing the actual ratio of outputs to inputs with the optimal ratio of outputs to inputs (Javed *et al.*, 2011). Generally, there are two approaches to measuring the efficiency estimates of a firm, that is, parametric and non-parametric approaches.

Parametric approaches

Stochastic Frontier Analysis (SFA)

This explicitly takes into account the existence of production inefficiencies, similarly to DEA, but, in addition, they make certain assumptions on the nature of the best practice technology. They proposed to distinguish three families of parametric methods: engineering approaches; average production functions; and stochastic production frontiers. These methods capture technical efficiencies, provided that the required data are available for multiple periods. According to Vasilis (2002), SFA recognizes the presence of errors and aims in principle to separate these error components from the measures of inefficiency. In practice, this effort is not always successful as, typically, the estimated inefficiency component represents a small fraction of the overall residual variation. This can make SFA vulnerable to outliers. Another possibility is that the stochastic frontier model may detect little or no inefficiency because it suggests that the distribution of the residuals has the "wrong" skew. In these cases, SFA collapses to simple OLS estimation. In a cost frontier model, a "wrong" skew means that the residuals have no significant positive skew.

Non-parametric approach

Data Envelopment Analysis (DEA) This method entails determining a frontier that envelops all the input-output data, with observations lying on the frontier defined as technically efficient, while those below are seen as being technically inefficient. DEA determines this frontier by constructing a virtual (or composite) producer with the highest possible efficiency, using farm-level data on outputs and inputs and without imposing any restrictions on the production technology. It does not require any assumption on the production technology of the farm/sector; It can be used at any level of aggregation that is, from the farm level to sector, country or even international levels; It allows for multiple outputs and inputs; Unlike SFA, it only requires data on quantities produced and inputs used and not on prices or weights. According to FAO (2017), this is a key advantage over other methods, given the high proportion of outputs and inputs in the developing world that are not marketed and, therefore, have no market price. Being a non-parametric technique, however, the main weakness of DEA is that it attributes all deviations from the frontier to inefficiency. Yet, as with regression analysis, deviations from the frontier may be due to a number of factors other than inefficiency such as omitted cost drivers and measurement errors (Visalis, 2002). Also, it is difficult to undertake hypothesis testing and measure the precision of the resulting indicator. For the purpose of this study, DEA was used because it assists in the decomposition of technical efficiency into total, pure and scale efficiency. It also decomposes efficiency scores into different return-to-scale efficiency indicators (Gelan and Muriithi, 2015). Further, it has also been found that the result from the DEA is more robust than those from the parametric analysis.

MATERIALS AND METHODS

Study Area

This study was conducted in Niger State. Niger State is located in the North-geopolitical zone, at the Northern Guinea Savannah ecological zone of Nigeria, between latitudes 8◦20'N and 11◦30'Nand longitudes 3◦30'E and 7◦20'E (Ojo *et al*., 2013). The Bureau of Statistics has maintained an approximate population growth rate of 2.5% geometrically. Based on that, the population of the State was 3,950,429 in 2006 which was projected to be 5,556,200 from 2016-2021 (Merem *et al*., 2021) with a total land mass of 58,676.2 square kilometres representing about 9.3 per cent of the total land mass of the country (NPC, 2006). The climate and ecological conditions of the State are favoured with a mean annual rainfall of 782-1250 mm and a mean temperature of about 82ºF or 27.7ºC (Mohammed *et al.,* 2014).

The State held a total of 215.87, 213.80 ha and 234.74 ha between 2007/2008, 2008/2009 and 2009/20010, respectively. Its output at 396.94 TMT, 512.37 to 524.16 TMT gained visible steam all through the same period with increments at levels that surpassed every State in the country. In the process, the production increases for the State also extended further deep into 2009/2010 to 2010/2011 at much higher levels of 546.62 TMT (Merem *et al.,* 2021).

Agriculture is the mainstay of Niger State's economy and major economic activities comprise farming, fishing and cattle rearing. Other economic activities (though limited in scale) include banking, trading, transportation, and local arts and crafts. These activities constitute the main means of livelihood of the people of Niger State in addition to public service engagement (Medium Term Sector Strategy (MTSS, 2019).

Sampling Techniques

A multistage sampling technique was adopted for the study as shown in Table 1. The first stage involved a random selection of two LGAs since all the LGAs were involved in groundnut production in the State. The second stage involved a random selection of two districts from each of the LGAs while in the third stage, two towns/villages were randomly selected from each of the districts. The fourth stage involved a proportionate sampling of 10% of the registered groundnut producers from each of the selected towns/villages which was accessed from Niger State Agricultural Mechanization and Development Agency, Hence, the total number of respondents for the study was 132 farmers. Questionnaires were administered to 132 groundnut farmers without any bias. The report from the field after the retrieval of the questionnaire showed that the respondents were made up of 92 males and 40 females for the study.

Table 1. Computation of sample size of the groundnut farmers

LGAS	District	Villages	Sample frame	Sample size (10%)
Shiroro	Kuta	Pina	351	35
		Gwada	410	41
Bida	Bida	Emigara	275	28
		Mungorota	280	28
	Total		1316	132

Source: Niger State Agricultural Mechanization and Development Agency, 2018.

Method of Data Collection

Cross-sectional data were used through field surveys with the aid of structured questionnaires supplemented with oral interview schedules to elicit relevant information on the production and processing factors and constraints to groundnut production and processing in the study area. Prior to this stage, enumerators were trained on the modalities involved in the administration of the questionnaire to minimize error. Both the researcher and trained enumerators administered the questionnaires to the respondents. Data were collected on output and various inputs used in production by both genders such as fertilizer, planting materials, labour, land, agrochemicals and capital inputs. In addition, information on various challenges militating against their desired optimum productivity was also collected

Analytical Techniques

DEA is based on a non-parametric linear programming technique which identifies an efficiency frontier on which only the efficient decision-making units (DMUs) are placed. It is widely used for estimating the technical efficiency of a set of DMUs that accommodates multiple inputs and outputs (Ahmed *et al.,* 2019). The DEA approach assumes that a set of DMUs is associated with their corresponding amounts of inputs and outputs. The efficiency score is defined as a ratio of the weighted sum of the outputs to the weighted sum of the inputs (Ahmed *et al.,* 2019). According to Ahmed *et al.* (2019), a DMU is considered to be technically efficient if it can produce maximum output from a given set of inputs. The efficiency score of the farmers ranges between 0 and 1. They are technically efficient if they have a score of one and *vice versa* if they are inefficient. DEA is mostly decomposed into total (CRS), pure (VRS) and scale technical efficiency. The constant return to scale (CRS) occurs when any level of increase in inputs proportionately increases the level of output. Variable return to scale (VRS) occurs when any increase in the level of input either increases or decreases the level of output. In the VRS assumption, a DMU may result in increasing returns to scale (IRS) which occurs when output increases by a greater proportion than the increase in inputs or decreasing returns to scale (DRS) when output increases by a smaller proportion than the increase in inputs. Scale efficiency is a measure of the extent to which a DMU deviates from an optimal scale. When a DMU is operating at CRS, technical efficiency is equal to scale efficiency as CRS technical efficiency denotes that the technical efficiency of a DMU cannot be attributed to deviations from optimal scale (required optimal size for given input and output mix). The scale efficiency is represented by the ratio of the scores from CRS technical efficiency and VRS technical efficiency.

We utilized an input-oriented DEA model as it focuses on minimizing the use of inputs for producing the given amount of outputs as used by Ojo and Ojo (2015) and FAO (2017). The mathematical problem of DEA is to find a set of weights that maximize the output expansion of the producer under consideration, under the constraint that the producer cannot be more efficient than the "best producer. Mathematically, the programme for a given producer 0 can be formulated as follows:

$$Max_{\varphi}, \theta\varphi$$

Subject to the constraints: $x_{io} \geq \sum_{i=1}^{I} \beta_i x_{io}$ ∀l = 1,….., N inputs…………………………...(1)

$\varphi y_{ko} \leq \sum_{i=1}^{I} \alpha_i y_{r0} \forall k = 1,....,$ output…………………………………………………..….(2)

$\theta_i \geq 0 \qquad \forall i = 1,....,I producers$

Explicitly, DEA can be re-written as:

$$\text{Max TE} = \frac{\sum_{r=1}^{s} \alpha_r Y_{ro}}{\sum_{r=1}^{m} \beta_i X_{i0}} = \frac{q}{q^*} \qquad ....(3)$$

Subject to :

$$\frac{\sum_{r=1}^{s} \alpha_r Y_{rj}}{\sum_{r=1}^{m} \beta_i X_{ij}} \leq 1, \; j = 1,.......,n \qquad ....(4)$$

$\alpha_r, \beta_i \geq 0$; r = 1, -----, s; i = 1, …., m

Where X_{ij} and Y_{ij} respectively are quantities of the i^{th} input and *rth* output of the j^{th} firm $\alpha_r, \beta_i \geq 0$ are the variable weights of output and inputs to be determined, respectively.

The weighted sums of inputs and outputs represent a composite producer that performs better than the producer under consideration: the composite producer uses fewer inputs (equation 1) and has an output that is always higher than what the producer under analysis might potentially expect (equation 2). The maximum expansion factor φ measures the distance between the observation and the "best" producer. This programme is solved for each producer in the sample, allowing the construction of the best practice frontier

(FAO, 2017). The annual output and inputs used in the analysis included the following:

OUT = Output of groundnut (kg)
LAB = Labour (Man-days)
PLM = Planting material (kg)
FMS = Farm size (ha)
FER = Fertilizer (kg)
AGR = Agro chemical (liters)
DEP = Total Depreciation (Naira)

The summary statistics and constraints faced by the groundnut farmers were achieved using descriptive statistics. A 3-point Likert-type rating scale was used to determine the constraints with three response options *viz* very severe (VS) = 3, Severe (S) = 2, and Not severe (NS) = 1. These values were summed up to 6 (That is, 1 + 2 + 3 = 6) which was then divided by 3 to get a mean score of 2.0. Then, each respondent's mean score was obtained for each response item such that any mean score higher or equal to 2.0 was regarded as a major constraint and any mean score below 2.0 was regarded as a minor constraint. It is expressed in equation 5 as:

$$\overline{X} = \frac{\sum F_n}{nr} \quad \text{.................(5)}$$

Where:
$\overline{X}$= Mean
$\sum$= Summation
F_n= Frequency of respondent responses
Nr = Number of responses

RESULTS AND DISCUSSIONS

Summary Statistics of Variables for DEA Analysis of Groundnut Producers

The summary statistics of the variables for the Data Envelopment Analysis (DEA) for groundnut production in the study area were presented in Table 2. They included the sample mean, minimum and maximum values as well as the standard deviation for each of the variables. The findings showed that the mean output of 6383.15kg was obtained from an average of 1.21ha of land for the male farmers while a mean output of 5543.13kg was obtained from an average of 0.94ha of land for the female groundnut farmers. Furthermore, it was revealed that the mean of labour was 218.63, seed (14.80), fertilizer (96.88), agrochemical (2.50) and capital input (3847.05) for male gender and, labour (251.63), seed (14.62), fertilizer (46.25), agrochemical (1.60) and capital input (11125.04) for the female gender.

The result revealed that the study covered small-scale farm units for both genders though the mean output and farm size of the male gender was higher than that of their female counterpart. This followed the *a priori* expectation that the male gender's access to farmland was easier than that of the female gender in the study area. This finding agrees with the findings of Olakojo (2017) who reported that the quantity harvested and harvest sales of male-managed plots were marginally higher than female-managed plots by 0.22% and 6.24%, respectively. Mugisha, *et al*. (2019) report also revealed 63% and 44% gender yield gaps for improved and local varieties of groundnut in Uganda, respectively, with female plot managers realizing less than their male counterparts.

Table 2: Summary statistics of the variables in DEA for groundnut production in the area

Variables (Per annum)	Mean	Standard Deviation	Minimum	Maximum
Male farmers				
Output(kg)/	6383.15	3490.72	2400.00	17500.00
Labour (man-days)	218.63	82.78	96.00	432.00
Seed (kg)	14.80	6.29	3.33	33.33
Farm size (Ha)	1.21	0.69	0.50	3.00
Fertilizer (kg)	96.88	46.50	25.00	200.00
Agro-chemical (litres)	2.50	0.83	1.00	4.00
Depreciation	3847.05	2482.96	550.00	11458.33
Female farmers				
Output(kg)	5543.13	2660.62	2625.00	12100.00
Labour (man-days)	251.63	49.06	144.00	336.00
Seed (kg)	14.62	2.78	8.67	21.33
Farm size (Ha)	0.94	0.49	0.20	2.00
Fertilizer (kg)	46.25	23.72	25.00	100.00
Agro-chemical (litres)	1.60	0.67	1.00	3.00
Depreciation	11125.04	7955.89	675.00	27936.67

Source**:** Authors' computation

Efficiency decomposition of male and female groundnut producers

Table 3 showed the efficiency score estimates in groundnut production by gender in the study area. Technical efficiency decomposition shows the effectiveness with which a given set of inputs is used to produce an output. On average for the male gender, 87% of the farmers were CRS technically efficient while 94% were VRS technically efficient. This implied that on average, they could reduce their input cost/mix by 13% and 6%, respectively, while still remaining within the CRS and VRS frontier. Predicted technical efficiencies however differed among sample farms, ranging between 0.53 and 1.00. In addition, 49 farms were efficient under VRS, that is, they had an efficiency score of 1.0 (100%) while 43 farms were inefficient.

On the female side, however, the mean result revealed also that, 87% of the female groundnut farmers were CRS technically efficient and 97% were VRS technically efficient. This showed that they could reduce their input mix by 13% and 3%, respectively, while still remaining within the CRS and VRS frontier. Predicted technical efficiencies also differed among sample farms, ranging between 0.64 and 1.00. The Table further revealed that 29 farms were efficient under the VRS while 11 farms were inefficient. In summary, instances of inefficiency witnessed by both genders implied that the farms might have employed more inputs than required to achieve the same output level and/or, might result from diseconomies of scale. This is tantamount to a waste of resources that could have been used in the production of additional output.

Unlike most research results, the findings of this research showed that the female gender was relatively more technically efficient than male gender in the production of groundnut in the area. The VRS result also showed that their administrative and management practices were also better. Nonetheless, both genders have the potential of increasing their efficiency level if they are trained in the application of modern practices and relevant technologies to their farming operations. This result disagrees with the findings of Ojo *et al.* (2010) and Ogunniyi *et al.* (2012) who reported that male farmers were more resource-use efficient than their female counterparts. Bocher and Simtowe (2017) reported that male-headed households, on average were 6% more efficient compared to female-headed households in groundnut production in Malawi. The finding was however at variance with the study conducted by Binuyo *et al*. (2016) who reported that none of the farmers reached an optimal level of efficiency with a mean efficiency of 63%.

Table 3: Efficiency score estimates in groundnut production by gender

	Male			Female		
Efficiency Score	**CRSTE**	**VRSTE**	**Scale Eff.**	**CRSTE**	**VRSTE**	**Scale Eff.**
< 0.70	1(1.1)	0	0	5(12.5)	0	4(10.0)
0.701 - 0.800	31(33.7)	11(12.0)	11(12.0)	10(25.0)	1(2.5)	6(15.0)
0.801 - 0.900	15(16.3)	14(15.2)	18(19.6)	9(22.5)	4(10.0)	10(25.0)
0.901 - 0.999	27(29.3)	18(19.6)	42(45.6)	6(15.0)	6(15.0)	10(25.0)
1.00	18(19.6)	49(53.3)	21(22.8)	10(25.0)	29(72.5)	10(25.0)
Mean	0.87	0.94	0.93	0.87	0.97	0.89
Standard deviation	0.11	0.09	0.09	0.11	0.06	0.11
Minimum	0.53	0.72	0.70	0.64	0.76	0.67
Maximum	1	1	1	1	1	1

Source**:** Authors' computation Figures in parentheses are the percentages

The scale of Operation of Groundnut Farms

The findings, as contained in Table 4, show the gender-based scales of operation of the groundnut farmers in the study area, that is, optimal, sub-optimal and supra-optimal scales. For the male gender, it was revealed that 23% of the farms were scale efficient and operated at optimal scale. If any modification is made, it would make these farms to be less efficient (Kao and Liu, 2011). Further, approximately 67% and 10% of the farms operated at the sub-optimal stage (stage of increasing return to scale (IRS)) and supra-optimal scale (stage of decreasing return to scale (DRS)), respectively.

For the female farms, 25% of the farms' scale of operation was optimal while 75% operated at the sub-optimal scale. No farm operated at the DRS. The implication of these results is that expansion of groundnut output reduced the per unit cost of groundnut on female farms than on male farms and that, a proportionate increase in the productive resources led to more than proportionate increase in output of the female farms than male farms. In essence, the female group farms were more scale efficient than the male group farms. However, in most farms, increasing the scale of operation could lead to higher efficiency levels. Sinare *et al.* (2021) reported that gender plays a key role in the production of groundnut in Burkina Faso and that 48.39% of women were engaged in groundnut cropping with less access to land and production resources. It was contained in that report that a yield gap existed between men and women with men achieving more yield than women in the area. The finding however is at variance with the report of Owusu and Bravo-Ureta (2022) that, males were more productive than female groundnut farmers and that closing the productivity gap will require expanding female production possibilities through the use of improved inputs and practices and enhancing managerial skill and know-how through extension services. The findings, however, corroborate the report of Bielik and Ranjčániová (2012) on the scale efficiency of agricultural enterprises in Slovakia and found that 10 per cent of the analyzed farms operated at the optimal scale, 77 per cent at the above optimal scale and 13 per cent below optimal scale.

Table 4: Scale of operation of groundnut farmers in the study area

Level of Efficiency	Male No. of farms	Female No. of farms	Scale of Operation
CRS (Scale efficient farms)	21(22.8)	10(25.0)	Optimal
IRS	62(67.4)	30(75.0)	Sub-optimal
DRS	9(9.8)	0(0)	Supra-optimal
Total	92(100)	40(100)	

Source: Authors' computation Figures in parentheses are the percentages

Comparison Test for the Differences in Mean Efficiency Estimate: The comparison test for significant differences in mean technical efficiency among the two farm categories was summarized in Table 5. The findings revealed that the mean CRS and VRS technical efficiency with scale efficiency were statistically and significantly higher on female farms than on male farms. This result disagrees with the findings of Coker *et al.* (2017) who reported that female farmers are still way behind their male counterparts, in terms of productivity. It, however, agrees with Ali *et al.* (2016) who reported that though men have greater access to inputs, input use was so low and inverse returns to plot size so strong in Uganda that smaller female-managed plots had a net endowment advantage of 12.9% partly because is the higher number of family labour days applied to female-managed plots per acre.

Table 5. Comparison test for the differences in mean efficiency estimate along Gender Lines

Efficiency measures	Male versus female	
	Mean difference	Significant level
CRS technical efficiency	0.11	0.001***
VRS technical efficiency	0.25	0.000***
Scale efficiency	0.05	0.001***

Source: Authors' computation *** denotes significance at 0.01 probability level

Input Slacks and Number of Groundnut Farms Using Excess Inputs

Table 6 showed slack inputs for groundnut farms in the study area. A slack variable represents the amount of excess expenditure on an input, that is, the amount by which the expenditure on a particular input could be reduced without altering the production level. It is evident in Table 6 that 21 male groundnut farms and 10 female groundnut farms could reduce total expenditure on the farmland by 1.21% and 0.94%, respectively, without reducing their current level of production. Capital inputs, fertilizer and seeds ranked 1st, 2nd and 3rd of male farms that used these inputs excessively while capital inputs, farm size and labour ranked 1st, 2nd and 3rd of female farms that used these inputs excessively. Similarly, excess expenditures on labour (6.06%), seed (8.85%), fertilizer (9.11%), agro-chemicals (5.60%), and capital inputs (22.33%) were estimated for male farms while excess expenditures on labour (2.75%), seed (2.53%), fertilizer (8.61%), agro-chemicals (5.00%) and capital inputs (24.06%) were estimated for female farms, respectively. The result implied that the resource use efficiency level of the farmers in both groups was low since many of the farms used excess inputs at varied levels of percentages.

Constraints of Groundnut Production Along Gender Line

The results in Tables 7 and 8 showed the constraints faced by the male and female groups and their weighted mean, respectively. It was revealed that unavailability of machinery for hire (WM=2.90), high cost of the machinery (WM=2.79), inadequate capital (WM=2.70) and inadequate rainfall/soil moisture (WM=2.65) ranked 1st, 2nd, 3rd and 4th, respectively as some of the major constraints faced by the male farmers while inadequate/poor road network (WM=1.82) and prevalence of pest and diseases (WM=1.61) which ranked 13th and 14th were the least of the minor constraints faced by male groundnut farmers in the area.

Table 6: Input slacks and number of groundnut farms using excess inputs in the study area

Inputs	No of farms using excess inputs	Mean slack	Mean input used	Excess input used (%)
Male farmers				
Labour (Mandays)	23	13.25	218.63	6.06
Seed (kg)	32	1.31	14.80	8.85
Farm size (Ha)	5	0.02	1.21	1.65
Fertilizer (kg)	33	8.83	96.88	9.11
Agro-chemical (Litres)	21	0.14	2.50	5.60
Capital input (Depreciation)	34	859.07	3847.05	22.33
Female farmers				
Labour (Mandays)	9	6.93	251.63	2.75
Seed (kg)	7	0.37	14.62	2.53
Farm size (Ha)	13	0.05	0.94	5.32
Fertilizer (kg)	8	3.98	46.25	8.61
Agro-chemical (Litres)	8	0.08	1.60	5.00
Capital input (Depreciation)	14	2676.31	11125.04	24.06

Source**:** Authors' computation

Table 7: Constraints faced by male farmers in groundnut production

Constraints	Weighted Sum	Weighted Mean	Rank	Remarks
Unavailability of machinery for hire	267	2.90	1st	MAC
High cost of machinery	257	2.79	2nd	MAC
Inadequate capital	248	2.70	3rd	MAC
Inadequate rainfall or soil moisture	244	2.65	4th	MAC
Use of low-yielding materials	230	2.50	5th	MAC
Difficulty in accessing credit	196	2.13	7th	MAC
High cost of seeds	187	2.03	8th	MAC
Inadequate supply of fertilizer	184	2.00	9th	MAC
Unavailability of improved seed	178	1.93	10th	MIC
High cost of labour	168	1.83	11th	MIC
Inadequate agro-chemicals	168	1.83	11th	MIC
Inadequate/poor road network	167	1.82	13th	MIC
Prevalence of pests and diseases	148	1.61	14th	MIC

Source**:** Authors' computation MAC = Major constraint; MIC = Minor constraint

The findings as shown in Table 8 revealed that unavailability of machinery for hire (WM 2.48), high cost of machinery (WM=2.48), excess workload (WM=2.38) and rainfall/soil moisture (WM= 2.23) which ranked 1st, 1st, 3rd and 4th respectively, were main major constraints faced by the female farmers while the high cost of labour (WM=1.85) and inadequate agro-chemicals which ranked 13th and 14th, respectively, were the least constraints faced by female groundnut farmers in the area.

The unavailability of machinery for hire and the high cost of machinery which were major constraints faced by both groups predisposes them to small-scale farming. The effect of this could be so overwhelming in terms of low yield, low productivity and low farm income. In addition, differences in terms of access to credit could lead to differences in degrees of participation in the labour market resulting in productivity differentials among the farming households in the area (Arcand and Borodak, 2006). The finding corroborates the report of Sinare *et al*. (2021) who found that the main constraints that hindered groundnut productivity of both genders were very similar and included lack of improved varieties, absence of agricultural credit, lack of production tools, the high price of seeds, the high price of fertilizer, drought and disease. The result, however, is at variance with the findings of Ajayi *et al.* (2020) who reported that the major constraints faced by groundnut farmers were a lack of government support, inadequate extension services and low income. It also disagrees with Modom *et al*. (2018) who reported that groundnut farmers perceived low-yielding varieties and diseases as major constraints to its production in Togo.

Table 8: Constraints faced by female farmers in groundnut production

Constraints	Weighted sum	Weighted mean	Rank	Remark
Unavailability of machinery for hire	99	2.48	1st	MAC
High cost of machinery	99	2.48	1st	MAC
Excess workload	95	2.38	3rd	MAC
Inadequate rainfall or soil moisture	89	2.23	4th	MAC
Inadequate capital	85	2.13	5th	MAC
Difficulty in accessing credit	82	2.05	6th	MAC
Use of low-yielding materials	81	2.03	7th	MAC
Inadequate supply of fertilizer	81	2.03	7th	MAC
Prevalence of pests and diseases	80	2.00	9th	MAC
High cost of seeds	79	1.98	10th	MIC
Unavailability of improved seed	75	1.88	11th	MIC
Inadequate/poor road network	75	1.88	11th	MIC
High cost of labour	74	1.85	13th	MIC
Inadequate agro-chemicals	70	1.75	14th	MIC

Source**:** Authors' computation MAC = Major constraint; MIC = Minor constraint

CONCLUSION

In conclusion, there was a relative differential in the productivity level of both male and female gender in the area and the female farmers' group performed better than their male counterpart during the period contrary to different literature that had reported otherwise. This study is very important because female farmers in Africa, with particular reference to Nigeria, have faced a lot of discrimination and are often rated as second-class citizens in their own country. But this study proved that they can actually perform better than their male counterpart when placed side by side in the context of groundnut farming coupled with relevant training and readily accessible modern technologies. Based on the findings, the following are therefore recommended:

1. Since the female gender was more efficient, a conscious and concerted effort should be made by the three tiers of government to empower the female gender so as to boost their morale for increased involvement in groundnut production in the area.
2. Farmers-extension officers' linkage should be intensified to reduce the wastage of resources through the provision of relevant guidance on how to harness their resources in the most efficient way.
3. Groundnut farmers should be encouraged through extension services to learn from farmers with 'best practise' so as to boost their efficiency level.
4. They should be equipped with relevant, modern but subsidized production technologies through different intervention programmes by the government and stakeholders to scale up their production and productivity.

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