ANALYSIS OF GENDER DIFFERENTIAL IN PROFITABILITY AND ACCESSIBILITY TO PRODUCTIVE RESOURCES FOR STRAWBERRY (*FRAGARIA CHILOENSIS*) PRODUCTION IN PLATEAU STATE, NIGERIA

***Elisha, W. J.[1]., **Oladimeji, Y. U[2]., Ouagbabe, O. O[3].**

[1, 2, & 3] Department of Agricultural Economics, Faculty of Agriculture / Institute for Agricultural Research, Ahmadu Bello University, Zaria, Nigeria
* Departmental Master of Science Graduate
** Corresponding author's e-mail: yusuf.dimeji@yahoo.com, +2348032220000

ABSTRACT
The study analyzed possible gender differentials in profitability and resource utilisation of strawberry (Fragaria chiloensis) production in Plateau State, Nigeria. Primary data were obtained through structured questionnaire in 2018 cropping season. Information collected includes socio-economic characteristics and production inputs and output in strawberry production. A multi-stage sampling procedure was used to select 298 farmers comprises of 116 male and 182 females. Descriptive statistics, net farm income and stochastic profit frontier models were employed to describe resource utilization, determine profit and profit efficiency respectively between male and female strawberry farmers. The results showed that there were statistically significant difference and disparities in the level of accessibility to resources between male and female who engaged in strawberry production. The total revenue was ₦95,152.72/ha for male and ₦156,320 for female while the total cost was ₦45,332.2/ha for male and ₦22,294 for female. The net farm income was therefore ₦49, 787.8 / ha for male and ₦134,026 for female. The average rate of returns on investment was 2.1 for male and 7.0 for female, indicating that for every ₦1 invested in strawberry production for male, a profit of ₦1.10 kobo and ₦6 respectively. The result of stochastic profit frontier model showed that the estimated coefficients of fertilizer and labour were the major factors influencing profitability of the male and female enterprise. Government should ensure timely and adequate supply of fertilizer to farmers through its e-wallet programme at affordable prices in order to enhance the production of this crop.
Keywords: Gender, resources, strawberry, stochastic profit frontier

INTRODUCTION
Nigerian agricultural sector provides a livelihood for the bulk of the rural population up to 70% active labour force. It also supplies raw materials required by the industrial sector and generate foreign exchange through export. In spite of this, agricultural production has failed to meet the food needs of the country's rapid growing population (Gyimah-Brempong *et al*., 2016). Yet, Nigeria is endowed with flowing rivers and a vast rich forest belt, fertile and cultivable arable land with about 98.3 million hectares across different regions for crop cultivations (Yusuf, 2015; Oladimeji & Abdulsalam, 2014).

Strawberry (*Fragaria chiloensis*) is an important small fruit among the berries particularly in Plateau state, Nigeria with various strawberry species grow wild all over the world. Nutritionally, strawberry is superior to citrus, guava and apple in the possession of higher protein, mineral and vitamin contents in addition to having more digestible starch. Strawberry provide potassium, iron, copper, magnesium, phosphorus and vitamins B6, B9, K and E some of which are essential ingredients to combat the hidden hunger arising from micronutrient deficiency. The great dietetic strawberry include; vitamin C. 100 gm, edible portion contains 89 gm water, 0.07 gm protein, 0.5 gm fats, 8.4 gm carbohydrates and 59 mg ascorbic acid (Ahmad *et al*., 2009).

Gender differences in productivity have been shown to be due to differences in the intensity of use of productive inputs such as labour, land, fertilizer, manure, credit, extension training and education rather than in differences in the efficiency or management styles of men and women (Quisumbing, 1994). Like many other countries in Africa, women in Nigeria have broadened and deepened their involvement in agricultural production in recent decades (WDR, 2015). Although men dominate the sector in Nigeria, a large share of women also participates across the agriculture value chain. Women are also involved in production, processing, and sales. Overall, about 48 % of female-headed households participate in the agriculture sector and, in the rural areas; almost 70% of female-headed households are involved in the sector (Damisa & Yohanna, 2007; Abdulrahman *et al.,* 2018).

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 in farming activities (Danso *et al*., 2014). Lower access to credit is thought to impact women's ability to engage in more productive irrigation farming, as this requires more expensive equipment and labor (Porter & Philips-Howard, 1997). Further, women's lower levels of agency and decision-making power may negatively impact their inability to benefit from their activities in the agriculture sector, as well as in other areas of their lives (Croppenstedt *et al*., 2013). Thus, there is a gap in decision making between male and female and this often turns out that in many cases, women use their land primarily for subsistence crops to feed their families while men cultivate cash crops and keep the income. Access to productive resources 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 (Food and Agriculture Organization, 2011).

Access to resources is essential to improving agricultural productivity of both men and women farmers. Improving productivity will depend to a great extent on ensuring that women farmers, as well as men farmers have sufficient access to production inputs and support services. While both men and women smallholders lack sufficient access to agricultural resources, women generally have less access to resources than men.While several studies have been carried out in the world on the determinants and profitability of agricultural production, empirical studies on the analysis of gender differential in profitability and accessibility to productive resources for strawberry production in Plateau state Nigeria are very scanty. Most of these studies concentrate on cereals and very few on tuber crops. It is therefore necessary to assess gender accessibility to resources among strawberry farmers in Plateau State; to establish a benchmark for developing strategy for promoting gender equity in the accessibility to resources involving strawberry farmers in the area and analyze farm profits between male and female strawberry farmers. Therefore, it is imperative to conduct this research analysis of gender differential in profitability and accessibility to productive resources in strawberry (*Fragaria chiloensis*) production in Plateau State Nigeria.

METHODOLOGY

This study was conducted in Plateau State, Nigeria. The State is located between Latitude 80 22' and 100 24' North and Longitude 80 32' and 100 38' East. Plateau State is primarily an agrarian community. The State has a land mass of 30, 913 square km or 6,678,162 acres (National Bureau of Statistics, 2006). About two thirds of the land area is arable. The

major food crops include Irish potato, sweet potato, chili pepper, tomato and strawberry. Others include leafy vegetables, cereals, legumes and root and tuber crops and tree crops. Vegetables include carrots, lettuce, radish, cucumber, sweet pepper, hot pepper, green beans, parsley and fruits include strawberries. However, cereal production on the Plateau represents about 34 % of all agricultural produce; root and tubers production represent about 32 % while horticultural crops stand out at about 21 %. The least is forest products which represent 13 % (Employment-oriented Private Sector Development Programme, 2010). Based on annual population growth rate of 3.2%, the projected population of the State is about 4,469,232 million people in 2019.

Primary data were used in this study. The primary data were obtained by the use of structured questionnaire in 2018 strawberry cropping season. Information on socio-economic and demographic characteristics of households, production information such as inputs used, output in strawberry and constraints faced by the farmers in strawberry production.

A multi-stage sampling procedure was used to select the strawberry farmers for this study. Three Local Government Areas (LGAs) namely: Barkin Ladi, Jos East and Jos South were purposively selected for field survey (Table 1). These LGAs were chosen due to possessing climatic and ecological features that are suitable for the production of strawberry in Plateau State. The list of villages involved in strawberry production was listed. The second stage involved a random selection of 20 % of the villages from each of the selected LGA and the selections of these villages were proportionate to the size. The villages selected are: Ropp, Kasa, Sho and Gashisha from Barkin Ladi (LGA); Lamingo, Kyerkyer and Rizek from Jos East (LGA); and Chigwi, Vwang, Chaha, Chwel, Sot, Kugwon and Kuru from Jos South (LGA).

Table 1: Population and sample size of strawberry farmers in Plateau State

Selected LGAs	Villages	Male farmers	Sample size male (24%)	Female farmers	Sample Female (24%)
Barkin Ladi	Ropp	23	6	45	11
	Kasa	18	4	61	15
	Sho	43	10	23	6
	Gashisha	18	4	64	15
Jos East	Lamingo	49	12	87	21
	Kyerkyer	35	8	44	11
	Rizek	17	4	34	8
Jos South	Chigwi	29	7	63	15
	Vwang	51	12	85	20
	Chaha	30	7	59	14
	Chwel	35	8	39	9
	Sot	46	11	25	6
	Kugwon	54	13	85	20
	Kuru	34	8	46	11
Total	**14**	**482**	**116**	**760**	**182**

Reconnaissance survey, 2018

The last stage involves using a Yammane (1967) formula adopted by Oladimeji *et al.,* 2017 for calculating sample size based on the assumption of 5% expected margin of error, 95% confidence interval and applying the finite population correction factor. The formula is expressed as follows:

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

Where: n_0 is the sample size without considering the finite population correction factor; e = 0.05; N = total number of observations. Therefore, a total of two hundred and ninety-eight (298) strawberry farmers for both male and female farmers were randomly selected using the card method.

Descriptive statistics and net farm income (NFI) were employed to estimate the costs and returns of strawberry production. The formula for the net farm income model is stated as follows.

$$NFI = TR - TC \quad (2)$$

Where, NFI= net farm income (₦); TR= total revenue (₦); TC= total cost (₦).

$$TC = TVC + TFC \quad (3)$$

Where, TVC= total variable cost (₦) and TFC= total fixed cost (₦).

Returns per naira invested (RNI) was obtained by dividing the gross income (GI) by the total cost (TC).Therefore,

$$RNI = \frac{(GI)}{TC} \quad (4)$$

Where, RNI = returns per Naira invested, GI = gross income and TC = total cost.
(Equations 2 - 4 adopted from Oladimeji *et al.,* 2018).

The stochastic profit frontier model was used to achieve factors affecting profitability of strawberry production. The empirical model is specified as:

$$\ln Y = \beta 0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + (Vi + Ui) \quad (5)$$

Where, ln = the natural logarithm, Y = Normalized total profit of strawberry (₦), X_1 = cost of seed (₦), X_2 = cost of fertilizer (₦), X_3 = cost of labour (₦), X_4 = cost of agrochemical (₦), β_0 = constant term, βi - β_4 = regression coefficients, vi = random variability in the profitability that cannot be influenced by the farmer and ui = deviation from maximum potential profit attributable to profit inefficiency of the farmer.

The inefficiency model is stated thus:

$$Ui = \delta_0 + \delta_1 1nZ_1 + \delta_2 \ln Z_2 + \delta_3 \ln Z_3 + \delta_4 \ln Z_4 \quad (5)$$

(Equations 4 & 5 adopted from Sani and Oladimeji, 2017).

Where: Ui = inefficiency effects, Z_1 = age of farmer (years), Z_2 = household size (number), Z_3 = formal education (years), Z_4 = farming experience (years), δ_0 = constant and δ_i - δ_6 = parameters to be estimated.

T-statistics was used to determine the significant difference between male and female accessibility to resources for strawberry production. These resources include farm size (ha), fertilizer (kg), seed (kg), agrochemical (litres), labour (man-days) and credit access (₦). It is a useful technique for comparing mean values of two sets of numbers. The formula is given by:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \quad (6)$$

(Oladimeji *et al.,* 2016)

Where: $\bar{X}_1$ = average resources utilized for male X_2 = average resources utilized for female σ_1^2 = variance from male resources, σ_2^2 = variance for male resources, n_1 and n_2 = sample size of male and female strawberry farmers.

RESULTS AND DISCUSSION

Level of Gender Accessibility to Resources for Strawberry Production

Table 1: Level of gender accessibility to productive resources

Male	**N**	**W S**	**MS**	**SD**	**CV**
Male and female have equal access to land	85	343	4.04	1.25	30.9
Land ownership increase your social status	90	376	4.18	0.77	18.5
Male and female have equal access to fertilizer	92	349	3.79	0.87	23.0
Male and female have equal access to seed	92	357	3.88	0.85	21.9
Male and female have equal access to chemical	89	337	3.79	0.86	22.7
Male and female have equal access to labour	86	302	3.51	1.11	31.6
Male and female have equal access to credit	83	159	1.91	0.26	13.6
Female					
Male and female have equal access to land	122	167	1.37	0.43	31.4
Land ownership increase your social status	133	561	4.22	0.88	20.9
Male and female have equal access to fertilizer	136	496	3.65	0.96	26.4
Male and female have equal access to seed	136	532	3.91	0.92	23.6
Male and female have equal access to chemical	133	499	3.75	0.92	24.6
Male and female have equal access to labour	126	237	1.88	0.26	13.8
Male and female have equal access to credit	124	232	1.87	0.59	31.6

Source: Field survey, 2018, SA=Strongly agreed, A= Agreed, U= Undecided, D=Disagreed, SD= Strongly disagreed, WT= Weighted total, MS= Mean score, SD= Standard deviation and CV = Coefficient of variation

The analysis of level of gender accessibility to resources for strawberry production and farmer's perception on accessibility to productive resources such as: land, labour, credit, fertilizer, seeds and agro-chemicals for their farming activities were discussed in Table 1. The results showed that there were disparities in the level of accessibility to resources between male and female who engaged in strawberry production in the study area.

The average score of (=4.04) obtained for perceived statement that male and female have equal access to land, while female farmers strongly disagreed (=1.37) to the statement. Majority of the female agreed that female do not have access to land as male due to financial constraint and mode of land acquisition. Female rarely own land in Nigeria, despite their heavy involvement in agriculture. Yusuf (2015) reported that lack of access to land remains a major constraint for female farmers in Africa and land reform programmes have led almost exclusively to the transfer of land rights to men heads of households. Since majority of female disagree with this statement and the score of 1.37 implied that female do not have equal access to land compare to men farmers who engaged in strawberry production. According to Kajoba (2002) in countries where ownership and inheritance laws have been reformed in favour of female, in practice female do not necessarily have more rights to land, as local customs act as barriers.

Land is a basic source of livelihood; providing employment, the key factor in agricultural activities, and a major determinant of a farmer's access to other productive resources and services. Famer's right to land is a critical factor in social status, economic well-being and empowerment. Limited access to land by female could be attributed to land tenure system which is strictly by inheritance. This finding is in line with Phillip *et al*. (2009) who

revealed that despite the significant role female played in agricultural production, female in Nigeria have relatively limited access to agriculture land and lower levels of inputs and use of extension services compared to men. In Nigeria, men are five times more likely than female to own land and this varies across regions, with lower ownership by female and higher gender gaps in land ownership in the North compared to the South (British Council Nigeria, 2012).

The perceived statement that land ownership increases your social status had a score of $\bar{x}$ =4.18 and $\bar{x}$ =4.22 for both male and female respectively. This implies that both male and female strawberry farmers agree that land ownership increases their status. This result showed that property rights to land affect economic condition of the household which translate to poverty reduction. According to WDR (2015) secured land property rights will increase the incentives of households and individuals to invest, and it will also provide farmers with better credit access.

In terms of access to fertilizer, seed and agrochemicals, it was agreed that both male and female have equal access to these productive resources. The perception obtained from the male farmers was similar to that of the female farmers. The men farmers agreed that there are no disparities in terms of accessibility to these productive resources (seed, fertilizer and agro-chemicals) used for strawberry production between male and female farmers who engaged in strawberry production. The mean scores obtained from both farmers is an indication that farmers had access to these inputs for production.

Labour is very important in small scale agricultural production; this is because farm operations are mostly labour intensive. The responses obtained from the female farmers showed they disagreed to the statement; male and female had equal access to labour ($\bar{x}$ =1.88). The female farmers mentioned labour to be expensive to hire and lack of funds to hire adequate labour. Among the male farmers, the mean score of ($\bar{x}$ =3.51) signifies agreement to the statement; of male and female having equal access to labour. In traditional settings, men are the head of households and this would enhance their easy access to family labour which made the male farmers to agree to the statement men and female had access to labour.

In terms of accessibility to credit resources used in strawberry production, both the male and female farmers disagree with this statement. The mean score of $\bar{x}$ =1.91 and $\bar{x}$ =1.87 obtained from the scale indicate that both male and female farmers do not agree to having access to credit. This suggests that the farmer's credit and availability of credit is an important factor in production. Yusuf (2015) asserts that credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. Therefore, lack of credit will have a negative effect on productivity.

The coefficient of variations of all the statement for both men and female were adjudged to be consistent with one another having low coefficient of variation that is within the 33 percent permissible upper fiducial limit of coefficient of variation. According to Johnson and Welch, (1939), the low coefficient of variation is a reflection of reliability (precision) of the result. Johnson and Welch (1939) reported that for a normal distribution, the ratio of mean to standard deviation should be of order of three or more.

T-test for Gender Difference to Productive Resources in Strawberry Production

The result of gender differential to productive resources was achieved through t-test as depict in Table 2. The result showed that there were statistically significant differences between all productive resources except usage of agrochemical, that is, farm size ($P<0.05$), fertilizer ($P<0.01$), Seed ($P<0.10$), labour ($P<001$) and credit utilized ($P<0.01$). These imply that there is a significant difference between the productive resources between male and female strawberry

farmers in the study area. Therefore, it can be concluded that the male and female farmers do not have equal access to productive resources in strawberry production.

Table 2: Distribution of significance difference between male and female strawberry farmers to productive resources (n=298)

Variable	Unit	Male		Female		T-value
		Mean	Variance	Mean	Variance	
Land	ha	2.76	0.491	1.05	0.345	2.09**
Social status	-	na	na	Na	na	na
Fertilizer	kg	205.64	13.00	179.04	27.93	2.88***
Seed	kg	0.387	0.098	0.472	0.042	1.72*
Chemical	litres	1.197	0.296	0.958	0.175	1.40
Labour	hours	241.8	13.9	153.00	21.02	3.06***
Credit (‘000)	naira	287.94	16.00	43.05	9.76	3.03***
bObservation		116		182		
Hypo. Mean Diff.		0				
DF		296				

Note: *** P<0.01; **<0.05 and **<0.10 levels of probability.

Gender Differential on Profitability of Strawberry Farmers

Table 3: Gender Differential on Profitability of Strawberry Farmers

	2016		2017		2018	
Variable	Male	Female	Male	Female	Male	Female
Seed	411.4 (0.91)	500(1.36)	-	-	-	-
	10,395.7	7,380	6750	6800	3500	3500
Labour	(22.94)	(20.05)	(42.7)	(42.3)	(40.9)	(38.6)
	20,760	15,750	5500	5500	1500	1800
Fertilizer	(45.80)	(42.81)	(34.8)	(34.2)	(17.5)	(19.9)
	2,811.1	2,300	2600	2900	2600	2900
Agrochemical	(6.20)	(6.25)	(16.5)	(18.1)	(30.3)	(32.0)
	10,000	10,000	-	-	-	-
Farm size	(22.06)	(27.18)				
	44,378.2	21,430	14850	15200	7600	8200
TVC	(97.9)	(97.65)	(94.0)	(94.6)	(88.8)	(90.5)
Depreciated fixed	954	864	954	864	954	864
Cost (FC)	(2.10)	(2.35)	(6.0)	(5.4)	(11.2)	(9.5)
	45,332.2	36,794	15,804	16,064	8,554	9,064
Total cost	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
Revenue	95,152.72	106,320	117, 600	112, 790	128,600	76, 921
NFI	49, 787.8	119,526	101,796	96,726	120,046	67,857
BCR = VNR / TC	2.1	2.9	7.4	7.0	15.0	8.49
T-test value		2.17**		1.05		2.54**

*Source: Field survey, 2018, Note: 1US$ = average ₦359 during the survey in 2018 and TVC denote total variable cost Note: ***, **, *, denote significant at 1, 5 and 10 % respectively*

The net farm income model was used to determine the profitability of the strawberry production. Table 3 gives the summary of inputs and revenue generated from the enterprise. Strawberry seed used by farmers in the study area were mainly unimproved seeds taken from the last harvest. The net farm income model was used to determine the profitability of the strawberry production. The quantity of strawberry seed used by male farmers was 0.4 kg/ha with an average market price of ₦ 1000 per kg and this constitutes 1.14% of the total cost of production. While female farmers 0.5 kg/ha with an average

market price of ₦ 1000 per kg was used and this constitutes 2.24% of the total cost of production.
The family labour was computed on the basis of opportunity cost in man-days. The wage rate varied according to farm operation performed. An average wage rate of ₦450 per man-day was used, giving the average labour cost per hectare to be ₦10,395.7 for male and ₦7,380 for female and these constitutes 22.9% 12.9% and of the total cost of production for male and female respectively for the first year of production. In the second and third years, the average labour cost per hectare to be ₦6750 for men and ₦6,800 for female and 3500 at the third year for both parties. Furthermore, the labour cost at second and third year constitutes more than one-third of the total cost of production for male and female respectively.

The quantity of fertilizer used was 207.1 and 150 kg/ha for male and female with an average market price of ₦105 per kg and this constitutes 45.80% and 70.7% of the total cost of production for male and female respectively. At second year of production only 50 kg of fertilizer was used by both farmers with an average cost of ₦5500 while ₦1500 and ₦1800 was spent by male and female strawberry farmers on fertilizer. The farmers make use of one litre of agrochemical each on average of half a hectare in the first year and one litre for second and third year. while the total cost of fixed inputs (depreciation of tools such as hoe, cutlasses and snap sac) incurred on strawberry production was ₦954 and ₦864 for male and female throughout the production cycle these constitute 2.1% and 3.88%, 6% and 5.4%, 11.2% and 9.5% for both male and female at first, second and third year respectively of the total fixed cost.

Results presented in Table 3 indicated the total revenue realized were ₦95,152.72/ha and ₦106,320/ha in 2016; ₦117,600 and ₦112,790 in 2017; ₦128,600 and ₦122,900 in 2018 for male and female respectively. The total cost for male and female were ₦45,332.2/ha and ₦36,794, ₦15,804 and ₦16,064, ₦8,554 and ₦9,064 for the 1st, 2nd and 3rd years respectively. The net farm income for male and female was therefore ₦49, 787.8 and ₦119,526, ₦101,796 and ₦96726, ₦120,046 and ₦113,836.the benefit-cost ratio for male and female was 2.1 and 2.9, 7.4 and 7.0, 15.0 and 13.6 for the 1st, 2ndand 3rd years respectively indicating that for every ₦1 invested in strawberry production for male, a profit of ₦1.10 kobo was made while for a female indicating that for every ₦1 invested in strawberry production for female, a profit of ₦1.9 was made for first year and at second and third year, ₦6.4 and ₦14 for male and ₦6 and ₦12.6 for female respectively. Thus, it could be concluded that strawberry production in the study area though on a small scale, was economically viable for both group. The difference in the strawberry production between male and female is probably attributable to exogenous factor, cultural factors and management practices.
The result of t-value also in Table 3 showed that there were statistically significant differences between net farm income (profit) of male and female strawberry farmers in 2016 ($P<0.05$) and 2018 ($P<0.01$) production year. These imply that male strawberry farmers thrived better than their female counterpart. The result is in line with study of Yusuf (2015) on comparative analysis of gender accessibility to productive resources in ginger production for poverty alleviation in Kaduna State, Nigeria.

Factors affecting profitability of strawberry production

Stochastic profit frontier model was used to determine the factors affecting the profitability of strawberry production presented in Table 5. The study revealed that the generalized log likelihood function were: -133.09 and -124.00 for male and female farmers respectively.

The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. Thus, the functional form that is, Cobb-Douglas used in this estimation is an adequate representation of the data.

Table 4: MLE of results of frontier profit efficiency of Strawberry production

Variable	β_i	**Male**		**Female**		**Pooled**	
Production variable		Coefficient		Coefficient		Coefficient	
Constant	β_0	0.028*	(1.82)	0.007*	(1.69)	0.013	(1.54)
Seed	β_1	0.002	(1.04)	0.063*	(1.80)	0.101	(1.28)
Fertilizer	β_2	0.206**	(2.21)	0.411***	(3.07)	0.205***	(2.79)
Labour	β_3	0.007***	(3.00)	0.075*	(2.09)	0.206***	(4.01)
Agrochemical	β_4	0.000	(0.64)	0.003	(0.87)	0.016	(0.92)
Inefficiency variable							
Constant	Z_0	0.005*	(1.71)	0.003**	(2.00)	0.112**	(2.31)
Age	Z_1	0.063**	(2.05)	0.211***	(3.42)	0.338***	(4.07)
Household size	Z_2	0.009	(0.84)	0.019	(0.76)	0.105	(0.86)
Education	Z_3	0.452***	(3.07)	0.116***	(2.60)	0.500***	(3.05)
Farming experience	Z_4	0.041	(0.49)	0.001	(0.76)		
Diagnostic Statistic							
Sigma-squared	(σ^2)	0.483**	(2.29)	0.499***	(2.48)	0.374**	(2.01)
Gamma	(γ)	0.530**	(2.17)	0.560***	(3.08)	0.411*	(1.97)
Log likelihood function	L/f	-133.09		-124.00		-98.95	
LR test		57.449		61.00			
Number of observation		116		182		298	

*Note: ***, **, *, denote significant at 1, 5 and 10% respectively, figure in parenthesis are t-value*

The gamma (γ) estimate of 53 and 56 % which were statistically significant at 5 % level of probability implies that 53 and 56 % of random variation in the profitability of the farmers was due to the male and female farmer's inefficiency and not as a result of random variability. Since these factors are under the control of the farmer, reducing the influence of the effect of γ will greatly enhance the profit efficiency of the farmers and improve their profit. The value of sigma squared ($\boldsymbol{\sigma^2}$) was 0.483 and 0.499 for male and female respectively indicates a good fit and correctness of the specified distributional assumptions of the composite error terms.

The result showed that the estimated coefficients of fertilizer (0206) ($P<0.05$) and labour (0.007) ($P<0.01$) for male farmers and seed (0.063) ($P<0.10$), fertilizer (0.4110) ($P<0.01$) and labour (0.075) ($P<0.10$) for female were positive and statistically significant. This implies that a unit increase in these variables will increase the profit made from strawberry by corresponding units. The result is comparable to the study of Oladimeji and Abdulsalam, 2014) on dry season irrigated vegetable farming in Nigeria.

Socio-economic variables were considered and estimated in the model and the results were also presented in Table 4. The result showed that the coefficient for age (0.063) and education (0.452) were positive and statistically significant for both male and female farmers. The significance of age implies that younger strawberry farmers are more profit efficiency than the older ones. The possible reason given may be due to the fact that as the farmers advanced in age, inefficiency in resource use increases while profit inefficiency increases.

Critical Issues and Limitations of the Study

Production: The life arc of strawberries begins with the establishment of a new plant, peaks 2 to 3 years later, and then proceeds toward senescence and death 2-3 years following its peak. Under ideal conditions, a strawberry plant can live up to 5-6 years

(Hummer *et al.*, 2011). However, for this study, only the first 3 years were considered for this research for most farmers in the study area plant the berry only 3-4 years.

CONCLUSION

Strawberry production was economically viable for male and female strawberry farmers in the study area. Farmers in the study area have limited access to major productive resources, but the females were more constrained. Providing resources in an efficient and equitable manner appears to have potential for greatly improving the scope for future poverty reduction in Nigeria. It is evident that, the two strawberry producers did not reach the profit frontier in strawberry production. Age and household size are major
socio-economic determinant of technical inefficiency for both strawberry producers.

RECOMMENDATIONS

Therefore,

1. Youths should be encourage to venture into agricultural production through agricultural education, training and agricultural scheme.
2. Fertilizer was a significant variable in production function; hence, adequate and timely provision and application of fertilizer with a good knowledge of application rate also has latent of increasing the output of the strawberry production in the study area.
3.

REFERENCES

Abdulrahman, S., Mani, J. R., Oladimeji, Y. U., Abdulazeez, R. O. & Ibrahim L. A. (2018), Analysis of entrepreneurial management and food security strategies of small ruminant women farmers in Kiri-kassamma Local Government Area of Jigawa State. *Journal of Animal Production Research*, 29(1), 419 – 429.

Ahmad, S., Afridi, G. S. & Ishaq, M. (2009). Cost and revenue analysis of strawberry production in the sub-tropical areas of NWFP, Pakistan. *Pakistan Journal of Life and Social Science,* 7(1), 59 - 65

British Council, (2012). Gender in Nigeria Report: Improving the Lives of Girls and Women in Nigeria. British Council, Nigeria. 2nd Edition, 99pp.

Croppenstedt, A., Goldstein, M. & Rosas, N. (2013). "Gender and Agriculture: Inefficiencies, Segregation and Low Productivity Traps", World Bank Research Observer, first published online January 20, 2013 doi:10.1093/wbro/lks024

Damisa, M. A., & Yohanna, M. (2007). Role of rural women in farm management decision making process: ordered Probit analysis. *Trends in Applied Science Research,* 2(3), 241-145.

Danso, G., Cofie, O., Annang, L., Obuobie, E. & Keraita, B. (2014). Gender and Urban Agriculture: The Case of Accra, Ghana. Paper Presented at the RUAF/IWMI/ Urban Harvest Woman Feeding Cities Workshop on Gender Main streaming in Urban Food Production and Food Security. 20-23 September, 2014. Accra.

Employment-Oriented Private Sector Development Programme, (2010). A Profile of the Plateau State Economy. Baseline Survey Report. Business Development Services/Value Chain Development. Conducted by Gopa Consultants Gmbh. Hindenburgring 18, D-61348 Bad Homburg.

Food & Agriculture Organization, (2011). The State of Food and Agriculture. FAO Publication. Rome. 160pp.

Gyimah-Brempong, K., Johnson, M. & Takeshima, H. (2016). *The Nigerian Rice Economy: Policy Options for Transforming Production, Marketing and Trade*. Philadelphia: University of Pennsylvania Press. Pp 4

Hummer, K. E., Bassil, N. and Njuguna, W. (2011). Chapter 2: Fragaria in C. Kole (ed.), Wild Crop Relatives: Genomic and Breeding Resources, Temperate Fruits, Springer-Verlag Berlin Heidelberg. 29pp.

National Bureau of Statistics, NBS (2006). National Abstract of Statistics.

Oladimeji, Y. U. & Abdulsalam, Z. (2014). An Economic analysis of dry season irrigated farming in asa river, Kwara State, Nigeria: implications for poverty reduction. *Journal of Sustainable Development in Africa*, 16(7), 1 – 15

Oladimeji, Y. U., Abdulsalam, Z., Muhammed-Lawal, A., Adefalu, L. L., Adepoju, S. A. (2016). Economic analysis and effects of water hyacinth (*Eichhornia crassipes*) on artisanal fishery of river Niger in north-central Nigeria. *Journal of Animal Production Research,* 28(2), 338-349.

Oladimeji, Y. U., Ajao, A. M., Abdullahi, A. N., Abdulsalam, Z. & Damisa, M. A. (2017). Adoption of improved technologies and management practices among bee farmers in north central and north western Nigeria towards Sustainable Development Goals. *Ethiopia Journal Applied Science Technology,* 8(1), 1 – 13.

Oladimeji, Y. U., Abdulsalam, Z. & Ayandotun, B. W. (2018). Profitability and energy gaps of semi-mechanised and traditional rice production technologies in north central and north western Nigeria. *Agricultural Engineering International: CIGR Journal*, 20(2), 116–125.

Phillip, D., Nkonya, E., Pender, J. & Oni, O. (2009). *Constraints to Increasing Agricultural Productivity in Nigeria: A Review.* NSSP Background Paper 6, International Food Policy Research Institute, Washington, DC.

Porter, G. & Phillips-Howard, K. (1997). Contract farming in South Africa: a case study from Kwazulu-Natal. *Journal of the Geographical Association*, 82(3&4), 1 – 38.

Quisumbing, A. R (1994). *Gender Differences in Agricultural Productivity: A Survey of Empirical Evidence*. Discussion Paper Series No. 36. The World Bank, Washington, DC.

Sani. A. A. & Oladimeji, Y. U. (2017). Determinants of technical efficiency among sorghum farmers under agricultural transformation agenda in Gombe State, Nigeria. *Nigerian Journal of Agric., Food and Environment*, 13(3), 122 - 129

World Development Report (2015). The World Development Report. New York.

Yamane, T. (1967). *Statistics: An Introductory Analysi*s, 2nd Editions., New York: Harper and Row.

Yusuf, H. O. (2015), *Comparative Analysis of Gender Accessibility to Productive Resources in Ginger Production for Poverty Alleviation in Kaduna State, Nigeria.* A PhD Thesis Presented to Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria. 121pp.