Economic Efficiency of Small holder Swamp Rice Farmers across Gender in Anambra State, Nigeria. An application of Stochastic Production Frontier Function

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Abstract: **Economic efficiency of small holder swamp rice farmers across gender in Anambra State, Nigeria was studied. The objectives of the study were to determine the level of economics efficiency and its determinants across gender and identify and analyze the constraints to swamp rice production in the study area. Multi-stage random sampling technique was used to select 120 swamp rice farmers (60 males and 60 females). Mean, maximum likelihood method and factor analysis were employed to address the objectives of the study. The result of mean economic efficiency of the male group (0.65) was higher than that of the female group (0.61). The cost of production of swamp rice to both male and female was affected by prfert (price of fertilizer), cptal (capital) and larent (Land rent). The determinant factors to economic efficiency that cut across both gender were educa (educational level), farmexp. (farming experience) and memorg (membership of organization), while only Accredit (credit) was to male farmer group. The problems of poor access to credit, poor access to post harvest technology, poor access to improved varieties and high cost labour cut across both gender. Policies to ensure farmers' access to credit, educational programme, improved rice varieties and labour saving devices were proffered.**

***Keywords*:, Economic efficiency, Farmers, Gender, Smallholder, stochastic frontier, Swamp rice.**

I. INTRODUCTION

In sub-Saharan Africa, South and East Asia and Latin America, the roles of smallholders farmers in promoting their food security are well documented (Food and Agriculture Organization, FAO, 2003, Ferrero and Tabacchi, 2002; Imolehi and Wada, 2012; Rice Farmers' Association of Nigeria (RIFAN), 2018).). For instance, smallholders is responsible for 70% of the food produced in Africa, 75 % of food supplies in South Asia (Cruiz,2009; FAO, 2019), and 70% of the food consumed in sub-Saharan Africa (West African Rice Development Association (WARDA), 2003). In Nigeria, small scale contributes more than 75 – 80% of the farming population and 85 – 90% of food produced in the country (National Burean of Statistics, 2009). This family farming, despite its important roles in alleviating hunger and malnutrition in these regions, they are characterized of net food buyers, undernourished and poor population (FAO, 2011). The responsibility for producing food crops, particularly where the production of both food for the household and cash crops does not squarely lies on male households alone, as women contribution is rapidly growing (Ndukwu, *et al*, 2010). For instance, women have been a pillar in agricultural production in many develop countries, where they contribute about 43 - 80 percent of agricultural labour and produces 70 percent of its food and involve in farm produce marketing up to the tune of 85%(Food and Agriculture Organization, FAO, 2015)

In 2018, United Nations Food and Agricultural Organization Statistics (FAOSTAT), reported that China, India and Indonesia in that order were the most three rice producing countries in the world with outputs of 206.5, 157.2 and 70.8 million metric tonnes respectively (Udemezue, 2019). Nigeria is currently the largest rice producing country in Africa with annual production increase from 3.2 million metric tons in 2015 to 4 million metric tons in 2017 (Rice Farmers' Association of Nigeria (RIFAN), 2018; Ume, et al,2018). In Nigeria, rice is a source of food security for more than 140 millions of Nigerians with average Nigerian consuming 24.8 kg of rice per year, source of poverty alleviation as it provides income to the producers, marketers, labourers and other people engaged in sales of rice farm inputs and machineries(Ugwungwu, 2008, Udemezue, 2019). Furthermore, rice contributes about 0.6 % of the National Gross Domestic Product (GDP) (Central Bank of Nigeria, CBN, 2013). Nigeria has a high growing demand for rice more any other countries in Africa and this could be correlated to rapid increasing per capita calorie consumption owning to population growth, rising income of rural and urban dwellers, changing consumers' preferences from local menu such as yam, cassava and ease of preparation of rice for meal (Onyenweaku and Ohajianya, 2002). The effect of the above scenario is the outstriping of domestic demand by local supplies, leading to successive governments in Nigeria spending billions of Dollars in food import to argument

domestic production. For instance in the year 2017 according to FAO, (2019) only about 56% of the 6.3 million metric tonnes of rice consumed in Nigeria annually is locally produced, while the supply deficit of about 2.6 million metric tonnes was augmented through imports.

The rice production feat in the country is accomplished by smallholder farmers that constitute the farming population and this class of farmers are often characterized by use of crude and primitive tools and rare use of hired since family labour use is primary (Ume, *et al;* 2013, FAO, 2015). In Nigeria, about 25% of the rice produced is through swamp production system with yields as high as 2 to 8 tonnes/hectare and accounted for 43-45 percent of national rice production (FAO, 2019). In the country, swamp rice production in particularly is beset with problems of low yield, high production cost, drought, lodging, weeds infestation, poor soil fertility, pests and diseases attack, and rodents attack (Ogundari, 2006; Rice Farmers' Association of Nigeria (RIFAN), 2018).

Gender is defined as the rules, norms, customs and practices by which biological differences between male and females are translated into socially constructed differences between man and woman and boys and girls (Kareem *et al.*, 2010). Gender tends to apportion assignment, responsibilities, opportunities and constraints of both men and women along different ethnic, religion and ecological lines (Ndukwu, *et al*; 2010). However, in most countries of African continent, gender division of labour also tends to be crop-specific, as women are more in cultivation of subsistence food crops than in non-food cash crops. For instance, swamp rice production has the following production activities bush clearing, clearing, tillage, pudding, planting, transplanting, weeding, fertilizer application, harvesting, threshing, winnowing, bagging, transportation, parboiling, drying, milling, bagging of milled rice and marketing (WARDA, 2003). These activities could gender specific in one aspect, while in the other facet due to certain circumstances such as female headed household, the jobs perform by both gender may not differ. The common swamp rice production activities performed by males in the study area are farm clearing, tillage, chemical application, harvesting and threshing, while women do the responsibilities of planting, weeding, fertilizer application, processing, storage and marketing (Onyenweaku and Ohajianya, 2002, Ume and Ezeano, Eluwa and Ebe; 2016).

However, basically, the ultimate aim of gender in agriculture tends to enhance agricultural productivity, food security, nutrition, poverty reduction and empowerment (Umar, *et al*; 2009; FAO, 2017). Literatures revealed that in most countries in sub Saharan Africa, women has been saddled with low productivities in their farms when compares to the male counterpart and reasons often linked to this scenarios, included women are highly constrained to important farm resources (such as land and capital). The other reasons are that women interests are never considered in policies and programme formulation by government agencies concerned , even in areas they (women) dominates and domineering and belittling of women by the male fork (FAO, 2015). Nevertheless, in Nigeria and many other countries in the region nowadays, the trend is changing for good through policies and programmes specifically established to address the welfare of the women. For instance in Nigeria literatures have shown that the establishment of Ministry for Women Affairs, Women in Agriculture (WIA), Better Life for Rural Women, Farmily Support Programme and among others have the prime aim of empowering women into arrays of entrepreneurial ventures, rice cultivation inclusive(Imoelehi and Wada, 2012, CBN, 2015). The success of these programmes and policies according to studies (FAO, 2003, Kareem, *et al*;2010, Ume, *et al;* 2016) are encouraging as women are in recent times occupying in many enviable positions administering the affairs of men and as well exposed in many enormous opportunities in the business world, thus changing their socioeconomics against what were obtainable in the past. In the course of this study, therefore, the need to estimate the economic efficiency of smallholder swamp rice farmers across gender in Anambra State, Nigeria is paramount. This is because to the best knowledge of the researcher, there is no published works patterning to the topic in the study area, taking into consideration discerning of the role of the women in promoting food security and poverty alleviation through rice cultivation.

II. METHODOLOGY

(2.1) Study Area

Anambra State of Nigeria was the study area and is in South East Agro ecological zone of Nigeria and located between latitude 5038 'N and 6047 'E of Equator and longitude 6036 'N and 7021 'E of Greenwich Meridian. The state is bounded in the east by Enugu State, in the West by Delta State, in the South by Imo State and in the North by Kogi State. The state Anambra State has Awka as capital with population figure of 4.184 million people (National Population Commission,(NPC, 2006). Anambra State has annual rainfall range of 1600 mm – 1700 mm, average temperature of 27^{oC} Anambra State comprised of four agricultural zones; Onitsha, Aguata, Otuocha and Awka.The inhabitant of the state are into crops and animal production.ry. The state is blessed with gari processing entrepreneurs. The off-farm employment opportunities in the State are trading, vulcanizing, barbing and tailoring.

(2.2) Sampling Proceedure and Sample Size

A multi-stage random sampling technique was used to select zones, blocks, cycles and respondents. First, two agricultural zones were purposively selected from four zones because of intensity of rice production in the areas. The selected zones were Aguata and Awka zones. Second, three blocks were randomly selected from each of the selected zones. This brought to a total of six blocks. Thirdly, ten circles were randomly selected from each of the six blocks, making a total of sixty circles. Finally, two respondents were selected from

each of the sixty circles. These brought to a total of one hundred and twenty (Sixty males and sixty females) for detailed studies

(2.3) Method of Data Collection

Data were collected from both primary and secondary sources. The primary data were collected with structured questionnaire which were administered to upland rice farmers in 2018 planting season, while secondary data were from journals, textbooks and other periodicals. Information collected using questionnaire was on the socioeconomic characteristics of the farmers such as age, sex, marital status, household size, years spent in schools, cassava farming experience, sources of finance, extension visits, membership of farmers association, farm size and method of acquisition of cassava farmlands, quantity and cost of variable and fixed inputs such as family labour, hired labour, fertilizers, herbicides, cassava stems, transportation, tractor services, hoes, cutlasses, wheel barrows and sacks and Output of cassava root tubers and revenue generated from the sale of the root tubers and stems

(2.4) Method of Data Analysis

Descriptive statistics such as percentage response was used to analyze the farmers' socio economic characteristics and production problems. Cobb-Douglas cost functional form of stochastic frontier was used to estimate farmers' economic efficiency.

(2.5) Model Specification

Economic Efficiency.

The model was represented as thus:

$\ln C=\delta_0 + \delta_1 \ln \text{Wagrat} + \delta_2 \ln \text{Prse} + \delta_3 \ln \text{Prfert} + \delta_4 \ln \text{Cptal} + \delta \ln \text{Laour} + \delta \ln p^{*} + V_i - U_i$ ..... (1)

Where:

ln= natural logarithm, C=total production cost by n^{th} farmer in Naira, wagrat = wage rate in Naira/man day, Prse = Price of rice seed in naira/kg, Prfert = price of fertilizer in Naira/Kg, Cptal = Capital (Naira) measured by depreciation charges on farm tools and equipment, interest on borrowed capital, rent on land, Larent. = land rent in Naira/ha, Y^{*}=output of rice in kg/ha, δ= coefficient estimated, V_i=symmetric error term representing the random variation in output due to factors outside the farmer knowledge, U_i= Non negative random variable representing inefficiency in rice production relative to the stochastic frontier.

Determinants of Economic Efficiency

The maximum likelihood estimation procedure, the computer software frontier version 4.1 was used to determine the factors contributing to the observed economic efficiency in rice production.

$EE=a_0 + a_1\text{Agfarm} + a_2\ \text{Fasize} + a_3\ \text{Hseize} + a_4\ \text{Educa} + a_5\ \text{Farm exp} + a_6\ \text{Accredit} + a_7\ \text{Extsev} + a_8\text{Memorg}$……(2)

Where EE= Economic efficiency, Agfarm = Age of famer in years, Fasize = Farm Size (Ha), Hseize = Household size (persons), Educa = Level of Education (Years), Farmexp. = Farming Experience (years), Memorg.= Membership to Organization (Member=1, otherwise=0), Accredit= Access to Credit (Access=1, Otherwise=0), Extsev.= Extension Services (Yes;1 and otherwise,0), a_0= Intercept, a_1-a_8= Parameters estimated.

Factor analysis

Factor analysis was used to identify the constraints to rice production in the study area. The principal component factor analysis with varimax –rotation and factor loading of 0.3 was used. The constraints as responded by the respondents were categorized into three factors using varimax rotation and factor loading of 0.30. The principal component factor analysis model is stated thus

$Q_1 = a_{11}\ r_1 + {}_{a2}\ r_2 + an_1\ r_n$..... (3)

$Q_2 = a_{21}\ r_2 + a_{22}\ r_{2+} a^2 rk$.....(4)

$Q_3 = a_{31}\ r_3 + a_{32} r_2 + a^3 nr_n$.....(5)

$Q_n = a_{n1} r_1 + a_{n2} r_2 + a_{nn} r_n$.....(6)

Where;

$Q_1 = a_n$= observed variable /constraints to rice production pdts

$a_1 = a_n$ = factor loading or correlating coefficients

$r_1 = fr_n$ =unobserved underlying limitation to rice production.

III. RESULTS AND DISCUSSION

(3.1) The Average Statistics of Male and Female Swamp Rice Farmers

Table 1 shows that the average age of a typical male swamp rice farmer was 45 years old, whilst the female counterpart,32 years.

Table 1: The Average Statistics of Male and Female Swamp Rice Farmers

Variable	Mean Value		Maximum		Minimum	
	Male	Female	Male	Female	Male	Female
Agfarm	45	32	70	68	35	20
Hseize	9	6.8	14	10	6	5
Educa	7.8	6	18	18	7	6
Farmexp	14.3	7.3	32	24	7	5.8
Larent	764	514	19,000	21,980	5,700	8,000
Extsev.	34	44	78	72	8	12
Farmsiz	0.34	0.32	4.5	2.8	0.054	0.008
Laub	57.4	21.4	650	480	198	127
Output	248.22	126.5	10,854	7,689	2854	1,230

Source; Field Survey; 2020

This implies that aged people dominated the farming population in both gender. The result is in synonymous with is often correlated with farming experience aimed at boosting their output frontier through increased productivity. In contrary, Emodi and Madukwe, (2008) and Ume, Ezeano Ede and Udeofia (2018)observed that youths dominated in their study. This farming group has the tendencies of being respective to innovation adoption and able-bodied to surmount the challenges of tedious nature of labour intensiveness, especially in rice production as seen in most developing countries where agriculture is still at rudimentary, they reported. In addition, household sizes of 9 and 6.8 persons for males and females respectively. Large household size is indication of availability of family labour especially during peak of farming season when labour is expensive and scarce to hire in boosting the farm productivity through enhanced efficiency. The above notion could only to be acceptable where the household members are of labour age, else they become a liability to the farming household head. This scenario could tantamount to the household head diverting much of the family income to the detriment of farm to take responsibility of the dependent population (Kareem; *et al;* 2010, Ume, *et al;* 2018).

In addition, typical male and female farmer groups were member of organization of 4.5 and 6.2 respectively. The aforesaid assertion in line with the work of Ume, et al; (2018). Organization according to Akande, (2003) assists members in ease of access to farm input such as credit from financial institutions at reduced interest rate and at no collateral demand. Additionally, an average farmer male and female cultivated 1.42 and 0.38 hectares of land respectively. This is in line with apriori expectation and finding of several studies (FAO, 2003, Umar, *et al*; 2009) that farmers in most developing countries are small holder farmers with farm holdings of less than five (5) hectares. The problem with land holding in the above scenario is that farms are in small portions and scattered, hence making commercialization and modernization using modern technologies adoption very difficult to accomplish (Olanrewaju, 2010; FAO; 2019).

Furthermore, an average extension visits to the farmers in male and female was 22 and 14 respectively. This is an indication of poor extension outreach by extension arm of Agricultural Development Programme (ADP) because of among others negative attitude of the charge agents to their duties. This bad attitude could be in inform of poor attendance to Fortnightly Training (FNT) where subject matter specialists tutor them on improved production recommendations on various innovations to be disseminated to the farmers(Ume, *et al;* 2013). Literatures (Fasika, 2015, Osagie, 2016; Abdulwaheed, Opadotun and Amusat, 2017) show that extension agents aids in dissemination of the finding of Ume, *et al*, (2016), who reported that old age information to farmers, giving technical assistant, directing farmers sources of inputs and in cooperative formation. However, poor motivation of the change agents by government agencies concerned and wide ratio of the extension agent and the farmers have diminished considerable the aforesaid functions of extension services in the study area and most countries in sub-Saharan Africa to the detriment of the farmers' welfare (Idong, 2006, FAO, 2019).Moreover, the means of male and female farmers in the group farming experience was 14.3 and 7.3 years respectively. The result connotes that most farmers were experienced, as result of among others long years of experimentations and observations, leading to improved efficiency and output maximization(Onyenweaku and Ohajianya, 2002; FAO, 2017). However, the finding of Imolehi and Wada, (2012) did not harmonize with the statement. They reported that the negative attitude of experienced farmers in most countries in sub Saharan Africa as they always want the status to remain could be rationale for the negative sign of the coefficient. As well, land rents of N764 and N514 were acquired by average male and female farmer group respectively. The number of hectares of land acquired by the farmer depends on the land rents, accessibility to the land, purposes of which the land is put into and soil fertility (WARDA, 2004; Osagie, 2016). Besides, the average formal education attained by the male and female farmer group was 7.8years and 6years respectively. The education status of the farmers is a divergence to popular knowledge that most farmers in sub Saharan Africa are illiterate. The level of education of the farmers could help them in being receptive to technology adoption and ease of having access to agricultural related information aimed at enhancing their efficiency and productivity (Umeh and Chukwu, 2013). Nevertheless, the negative conception of educated people to agriculture in favourite to "white collar" vocation may perhaps be the reason for negative sign of the coefficient as reported by Olanrewaju, (2010) in their study. As well, the male and female farmers employed an average of 57.4 and 21.4 mandays of labour respectively to produce an average output of 248.22kg and 126.5of swamp rice per annum respectively. The low manday labour could be correlated to high proportion of use of family labour in farming, without incorporating their contribution in when calculating their total costs of production Abdulwaheed, *et al;* 2017).

.(3.2) Estimated cost function

The maximum likelihood estimates of the cost frontier functions for swamp rice production in Anambra State is shown in Table 2.

Table 2: Maximum likelihood estimates of the Cobb Douglas stochastic production function for Swamp Rice farmers Across Gender in Anambra State, Nigeria

Production factor	Parameter	Coefficient Male	Coefficient Female
Constant	δ_0	1.3090 (3.9101)***	0.4492 (5.6003)***
Wage rate	δ_1	0.1450 (0.6310)	0.7201 (0.2881)
Price of seed	δ_2	0.4284 (0.7111)	4.0272 (0.7340)
Price of fertilizer	δ_3	5.2174 (1.0722)**	0.4880 (0.2811)**
Capital	δ_4	0.5990 (1.3325)***	7.7329 (0.7121)
Land rent	δ_5	1.770 (2.1013) *	0.9450 (0.5110)*
Output	δ_6	0.6275 (1.0213)***	0.2990 (2.1074)*
Efficiency factor			
Constant	M_0	2.9873 (3.0976)***	3.1279 (7.3373)***
A gfarm	a_1	1.3290 (2.5543)**	1.3245 (1.4410)*
Fasize	a_2	0.6510 (0.2205)	0.3790 (0.3211)
Hseize	a_3	1.6370 (0.4218)	0.3340 (0.2378)
Educa	a_4	0.4213 (4.3342)***	0.2995 (-1.0665)*
Farmexp	a_5	0.9822 (4.0901)***	1.6098 (2.0097)**
Memorg	a_6	0.6221 (4.6641)	2.0091 (2.1007)**
Accredit	a_7	5.1021 (0.6371)***	0.0191 (-1.0013)*
Extsev.	a_8	3.0007 (0.7099)	0.6543 (0.0980)
Diagnostic statistics			
Total variance	0.5430 (4.0087)***	0.3661 (3.1070)***	
Variance ratio	4.1289 (6.0071)***	7.2876 (6.1777)***	
L.R test	10.4432	4.5467	
Log likelihood	7.0098	6.7990	

Source: Field Survey, 2018

The total variances for both male and female were significant at 1% probability level respectively, implying goodness of fit and correctness of the assumption of the composite error. The variance ratio for both farmer groups were significant at 1% probability level respectively, indicating the variability in the output of the output of the swamp rice farmers groups that are unexplained by the function, which is due to inefficiency. The work of Ume, et al; (2012) made similar finding. Table 2 shows that land rent and price of fertilizer were significant in both gender at different significance levels but capital was only significant at 1% alpha level in male farmer group. The implication is that increase in any of the variables will increase the output of the rice enterprise by the significance level of the coefficient of the variable. In specific terms, 1% increase in the use of capital would increase rice output by about 0.6 %. The statistical non-significance of improved seed and wage rate could be linked to use of local varieties and family labour that commands no wage respectively by the farmers. The finding is synonymous with of Nwaobiala and Ume, (2013) on economic analysis of upland rice production in Ebonyi State of Nigeria

(3.3) Sources of economic efficiency

In compliance to *apriori* expectation that the efficiency of the age of farming household head decreases as they start aging at different probability levels to both gender. The result do not conform to the findings of Imolehi and Wada; (2000) and Onyenweaku and Ohajianya, (2002), who posited that aged farmers are equipped with necessary skills acquired through many years of farming that may perhaps assist them in attainment of optimal outputs through efficient in accomplishing their farm works. As expected, the estimated coefficient of level of schooling (Educational level) was positive and significant to economic efficiency for male farmers at 1.0% but negative for the female farming group at 5% alpha level. The negative sign of the female coefficients, which was in conformity to Ndukwu, et al; (2010) could imply low educational attainment and this scenario could be a disincentive in utilization innovations or information disseminated by extension services or research intuitions inclining towards increasing their efficiency in their use of resources for high yield. Several literatures emphasis on the important of educational attainment in enhancing the farmers' efficiency of resource use and in making rational decisions on

the daily activities of the farm management for increased productivity (Jirgi, *et al*; 2009, Osagie, 2016)

More so, the coefficient of farming experience was positive for all genders across the gender in agreement to apriori knowledge, although at different significant levels to economic efficiency. This agrees with Abedullah and Mushtaq, (2007) and Okam, Yusufo, Abdulrahman and Suleiman, (2016) who reported that individuals, farmers inclusive through repetition of certain farming activities over long period of time, they become more acquainted to the practice and commit less errors leading to high economic efficiency in the long run. In addition, the coefficient of level of membership of organization had positive relationship with efficiency in both gender and supported the *apriori* expectation that efficiency of farmer increases as get involved in cooperative matters. Studies (Onyenweaku and Ohajianya, 2002; Ndukwu, *et al*; 2010; Ume, *et al*; 2012) inferred that members of organization through exchange of ideas and information could improve their farming efficiency. As well, access to credit had positive relationship with efficiency among male group and negative in the female in agreement with *apriori* expectation. Credit access as reported by Emodi and Madukwe, (2008) and Osagie, (2016) assists farmers to hire labour and purchase material inputs for improving farmers' efficiency.

(3.4) Economic efficiency indices

Table 3 shows the frequency distribution of economic efficiency of Swamp rice production in among gender in Anambra State of Nigeria.

Table 3**:** Frequency distribution of gender according to economic efficiency indices

Indices	Men		Women	
	Frequency	Percentage	Frequency	Percentage
0.20-0.29	2	3.3	3	5
0.30-0.39	5	8.3	5	8.3
0.40-0.49	5	8.3	7	11.7
0.50-0.59	8	13.3	12	20
0.60-0.69	11	18.3	6	10
0.70-0.79	10	16.7	5	8.3
0.80-0.89	13	21.7	14	23.6
0.90-0.99	6	10	8	13.3
Total	60	100	60	100

Source: Field Survey, 2018

Maximum cost efficiency 0.98; 97, minimum economic efficiency;0.25,0.23 mean economic efficiency=0.75; 72. Female = Maximum cost efficiency= 97, minimum economic efficiency= :0.23, mean economic efficiency= :0.62.

The male had maximum, minimum and mean economic efficiency of 98%, 25% and 75% respectively. The female folk had economic efficiency ranged from 23% to 97% with a mean of 72%. The low mean efficiency in the farmer group (Male; 25; female;23%) is indication of gross under-utilization of resources, while high value of maximum economic efficiency for the gender (Male; 98, female; 97%), implies that best economically efficient gender farmers were almost operating on the frontier .The implication of the maximum and minimum efficiency figures by gender entails that an average male and female farmers in the group needed 15% and 18% respectively to fall short of attainment of the maximum possible level. This details that for an average best male farmer in the group to attain the frontier needed cost saving of 25.5%, while the least of the worst 10 male farmers required a cost saving of 78.6% to become the best efficient farmer in their group. Similarly, for the best female farmers required cost saving of 28.6% to attain the frontier, while the least of the worst 10 female farmers required a cost saving of 77.3% to become the best efficient farmer in their group. However, the work of Ndukwu, et al (2010) had similar, they had maximum, minimum and mean economic efficiency of 99%, 24% and 76% respectively for male farmers, while female ones had maximum, minimum and mean economic efficiency of 23% to 95% with a mean of 74% respectively.

(3.5) Gender constraints to upland rice production

The constraints to rice production are shown in Table 4**.** Herein, three factors were used based on the answersa by the respondents, Factor 1= economic/institutional factor, Factor 2 = infrastructural factor and Factor 3 = socio-financial factor (Ume, et al 2016). Only variable with factor loading of 0.30 and above at 10% overlapping variance could be used in identification of the factors.

Table 4. Varimax-Rotated Factors Against Swamp Rice Production Constraints

Variable	Male			Female		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Credit	0.324	0.045	0.008	0.109	0.452	0.0123
Pests and Diseases	0.007	0.309	0.067	0.002	0.346	0.091
Extension Service	0.410	0.239	0.109	0.302	0.009	0.027
Paddy problem	0.029	0.401	0.003	0.223	0.225	0.319
Improved Seed	0.329	0.129	-0280	0.446	0.244	0.008
Soil fertility	0.009	0.321	0.406	- 0.281	0.116	0.331
Price of product	0.222	0.331	0.120	0.007	0.459	0.212
Pesticides	0.102	0.332	0.220	0.229	0.336	0.164
High Cost of Fertilizer	-0.008	0.441	0.006	0.132	0.324	0.151
Theft	0.110	0.330	0.118	0.229	0.339*	0.115
Poor road network	0.009	0.105	0.372	0.012	0.200	0.395
Poor harvest technologies	0.216	0.006	0.319	0.051	0.102	0.413
High cost of Labour	0.124	0.365	0.019	0.005	0.321	0.009

Source; Field Survey; 2018

The factors with factor loading of 0.3 and above were considered as limiting factors to swamp rice production in

Anambra State.The factor loading of less than 0.30 was regarded as not a constraints to rice production in the study area., while those factors that are loaded in more than one factor were eliminated. The discarded factors were theft, soil fertility, and price of the product. Limitation under the economic /institutional factor were poor access to credit (male; 0.324, Female; 0.452) and unavailability of improved rice seed (male;0.329, Female; 0.446), poor access to extension services (Male; 0.410, Female; 0.302). The problems of poor access to credit cut across both gender. Poor access to credit facilitates as reported by varied literatures particularly poor resource farmers may possibly be owning to grace period of the loan and ignorance of the loan facilities in our lending agencies (Kareem, *et al*; 2010). Ume, et al; (2012) concurred to above assertion. They stated the important of credit in transformation of agriculture from peasant to commercial type, particular in developing countries because among others the poor resource nature of the farmers. Besides, the problem of poor access to improved rice seeds at farm level in the study area. The findings of Nwaobiala and Ume, (2013) corresponded to the assertion. Umar, *et al*; (2009) and, Okam, *et al*; (2016) reported that there is problem of unavailability and poor access to improved rice seeds that are tolerant to diseases and pests, resistant to drought, aggressively competitive against weeds, and high yielding especially by farmers in sub-Saharan Africa, thus leaving them to no better options than to plant local varieties that are of low yielding leading to low productivity. Also, the poor access to extension services by the farmers has decreased significantly the farmers productivity, owning to low access to recent research improved technologies and as well sources of procuring improved rice and other production inputs to boost farmers' welfare (Jirgi, *et al*; 2009). Several studies (Emodi and Madukwe, 2008, Idiong, 2006, Idris, *et al;* 2013) agreed to poor extension outreach by most farmers in developing countries. They posited on the important of agricultural development through dissemination of innovations to the farmers at appropriate time by extension agents.

Under infrastructural factor, poor road network (Male, 0.319, Female; 0.413) paddy problem (Male; 0.401; Female; 0.319), poor access to post harvest technologies (Male, 0.319; Female; 0.413) were considered. Most rural areas roads in most developing countries are not motor able, filled with potholes and untard, hence impassable during rainy season to convey farm inputs and inputs to and fro from rural to urban areas (FAO, 2011). Jirigi et al; (2009) made comparable statement in their study in Katcha Local Government Area of Niger State,Nigeria.

Additionally, inadequate paddy has affected rice production in the study area. Ogundai, (2008) work gave credence to the above assertion. He reported that in most sub-Saharan Africa, paddy soils are often water logged, degraded, in salinity and poor in terms of fertility as result of agents of denudation such as erosion, hence leading to low rice production and productivity. Also, poor access to post-harvest technologies such as threshing machines, combine-harvester, lack of dryer, consequently leading to many farmers using traditional post harvest technologies which are often very not efficacy, leading to loss and disincentive to farmers enhancing their production frontiers(FAO,,2003; Fasika, 2015)

The variables under socio-financial factors were fertilizer (Male; 0.441; Female; 0.324), high cost of pesticides(Male; 0.332; Female; 336) and .high cost of labour (Male; 0.365, Female; 0.321) and pests and diseases (Male; 309, Female, 346). High cost of fertilizer was reported as problem. The above statement was line with finding of Faska, (2015). Rice Farmers' Association of Nigeria (RIFAN) (2018) reported that poor access to fertilizer by the farmers could be attributed to the attitude of some unpatriotic Nigerians in diverting the Federal Government fertilizer allocation to the State to the neighbouring States, hence denying the farmers the singular opportunity of procuring the resource at government price. In a bid to sustain their farm productivity, most of the farmers seek for black market which is often very expensive to procure (Ume, *et al*; 2013). In addition, pesticides are used to control pests and the abuse results to environment/water pollution. Therefore, there is need to assist farmers through training farmers in the application of bio-control methods and bio-pesticides. In addition, high labour cost was noticed across gender but more severe with the female folks in all the zones. The high cost of labour compounded by youth migration to urban area leaving the farm operations to aged fathers and mothers, leading to production and productivity. Numerous studies (Akande, 2003, Idris, *et al*; 2013, Emeodi and Dimelu, 2014; Ume, *et al*; 2016) are in agreement to the statement. They opined that labour in rice production (ploughing, planting, weeding, harvesting, threshing, and transportation) are strenuous and laborious and carried out with tools (hoes, slashers, sickles, axe, and rake) which are rudimentary in nature, labourious and time consuming by the farmers (Imolechi and Wada, 2012; Kaine and Ume, 2018).Moreover, the problems of rice pests and diseases ws reported by the respondents. Ugwungwu, (2008) agreed on problems of pest nd disease infestation as hindrance to rice food sufficiency. He pointed out pests and diseases such as blast, bacterial sheath blight and stem borer are capable of causing increased in cost of production, reduction in rice productivity and quality through among others more broken rice, and extending of rice grain ripeness

IV. CONCLUSION AND RECOMMENDATIONS

In line to the research findings, the following conclusions were deduced; Men have slight margin of mean economic efficiency than women compare to what were obtainable by several studies in the past. Second, price of fertilizer, capital and land rent affected cost of rice production in both gender. Third, the determinant factors to economic efficiency that cut across both gender were educational level, farming experience and membership of organization, while only access to credit

affected male farmer group alone. Fourthly, the problems of poor access to credit, poor access to post harvest technology, poor access to improved varieties and high cost of labour cut across both gender.

Based on the conclusion, the following recommendations were proffered

1. There need to enhance both gender access to educational programmes such seminars, workshops and adult education by appropriate government agencies and nongovernmental organization in order to enhance their skills for improve economic efficiency to be attained.
2. Experienced farmers should be encouraged to remain in the rice farming through making available to them improved rice farm inputs such as fertilizer, improved rice varieties and pesticides by appropriate government agencies and nongovernmental organization at affordable price. The government in collaboration with organized private sectors should sponsor the appropriate research institute to develop such varieties and sold to the farmers at affordable prices.
3. The farmers should be encouraged to form cooperatives or join the existing ones in order to improve on their production and productivity through having access to farm inputs at affordable prices from the government agencies in charge
4. There is need for the Federal Government of Nigeria to revitalize her fertilizer production company at Onne Rivers State and, as well subsidize the resource cost and make it available to the farmers through adequate allocations to the States for onward distribution not to privileged individuals that divert them to the neighbouring States or sold the fertilizer in the black market.
5. The need to improve the accessibility of female farmers to credit through microfinance banks and commercial banks, as this will encourage them to remain in the business of rice production which is more capital intensive compares to other staples in the study area.

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