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Comparative assessment of economic returns on the well-being of adopters and non-adopters of improved melon processing technology in Niger state, Nigeria

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Abstract: Economic returns play an important role in the attainment of improved well-being of the farming households. This study was carried out to compare economic returns and its implication on the well-being of adopters and non-adopters of improved melon processing technology. Simple random sampling technique was used to select one hundred and ninety (190) melon processors/marketers for this study. The economic return of melon processing was estimated using the budgetary analysis while well-being was measured as the sum of money spent to cater for basic needs through the proceeds obtained from sales of shelled melon. Gross Margin (GM) obtained from sales of shelled melon seeds using improved melon sheller was ₦47,530.00/week compared to ₦2,230.01/week obtained for hand shelled melon. The findings show that 65.3% adopters spent more than ₦5,000/month to purchase food stuff while 6.0% non-adopters spent between ₦3,000 – 4000/month on food stuff; 98.9% adopters spent between ₦2,500 – ₦12,000/session on their children's education but 93.7% of non-adopters spent less (₦1,500 – ₦3,000) on their children education; 99.5% adopters made appreciable savings up to ₦2,000 – ₦10,000/week compare to 96.5% non-adopters that saved below ₦3000/week. This study established that economic returns obtained from improved melon sheller contributed more to the meeting of basic needs of the adopters than their non-adopters counterpart. Result of the t-test indicated significant difference existed between economic returns ($t = -42.38, p = 0.00$) of the adopters and non-adopters in the study area. Well-being of the adopters and non-adopters were also significantly different ($t = -57.4, p < 0.05$). Thus, the study recommends that rural women should continue to adopt improved melon processing technology rather than manual method to enhance their productivity.

Keywords: Economic returns, Well-being, Adopters, Non-adopters, Improved melon technology

INTRODUCTION

The declining agricultural productivity, high post-production losses, low economic returns and poor well-being of rural women in developing countries call for concern. Of the world's 1.2 billion extremely poor people surviving on less than US\$1 a day, 75 percent live in rural areas (International Fund for Agricultural Development (IFAD), 2012; Wu *et al.*, 2010). For the most part, they depend on agriculture and related activities for survival (Ravallion *et al.*, 2009). The World Development Report acknowledges the enormous potential the agricultural sectors of developing countries possess (World Bank, 2009). The dominant role of agriculture stems from among other impacts, increased farm outputs and rural income generation which ameliorate the effects of hunger, starvation, food scarcity, and social problems of unemployment. On the other hand, agricultural development relates not only to increase in the level of farm productivity but also the improvement in rural income generation and sustained well-being of rural dwellers. Historically, agricultural income is a more stable indicator of welfare analysis of rural household. It has a transitory character through the process of earning and consumption (Benson *et al.*, 2004). Agriculture constitutes the single largest contributor to the well-being of the rural poor, sustaining 90% of the rural labour force (World Bank, 2010). Rural dwellers are no doubt the supposed first

stakeholder beneficiaries of agricultural development in Nigeria. It holds a lot of potentials for the future economic development of Nigeria as it had done in the past (National Bureau of Statistics (NBS), 2012). However, these potentials have remained largely untapped which has led to the dwindling performance of the agricultural sector both domestically and in the international trade over years (Akinwunmi, 2012). The case of women who are often cited as able to produce about 80% of basic food seems worst (Ampadu-Ameyaw and Omari, 2015). Although they have prime responsibility for food production, they remain malnourished and still live in a closed circuit of economic deprivations (Nwanesi, 2006). As women they usually lack technical knowledge, and often have poor access to current information, technology, markets and credit, which all contribute to their poor economic status (Olutunla, 2008).

Important determinants of living conditions of households and their members are economic activities in which they are engaged and the returns they are able to reap from there (NBS, 2012). Many households in Nigeria, especially rural women are increasingly engaged in post-production of agricultural produce. It has become clear worldwide that the most rapid growth in agriculture has been occurring on the part of post-production activities (Punjabi, 2007). This is driven by growth of middle-income consumers even in low income

countries and their demands for better-quality value-added products. Empowering women in developing countries through small-scale agro-processing is essential to reduce poverty among rural women (UNRISD, 2010).

In Nigeria high proportion of rural women is involved in processing, marketing and utilisation of melon seeds and products (van der Vossen *et al.*, 2004). This implies that melon processing is capable of determining socio-economic well-being and welfare of the rural women and their families. Women spend their incomes on their children education, feeding, health care, ploughing back of profit to their melon processing activities, acquisition of household assets, and social relationship. Duncan (2004) opined that economic prosperity of rural dwellers is often linked to the achievement of effective integration and synergy between agricultural produce, agro-processing and marketing. However, very little information is available in literature on the rural women adoption of improved melon processing technology and extent to which it has contributed to high productivity, increase economic returns and better well-being of rural women because these benefits can guarantee its full adoption, utilisation and sustainability. The focus has always been on technical efficiency of the technology in the workshop. Empirical studies have shown that gains from adoption of new agricultural technology influenced the poor directly, by raising productivity and income of farm households, and indirectly, by raising employment (Evenson and Gollin, 2003; Diagne *et al.*, 2009). Hart *et al.* (2005) affirms that the improved technology contributes to agricultural development in terms of increased production output, higher income, and improved standard of living. In contrast, non-adoption of improved technology or used of conventional or manual method of shelling melon is inefficient, tedious and timing consuming thus limiting production output, market supplies and economic returns (James *et al.*, 2011). It therefore becomes imperative in this study to compare economic returns of adopters and non-adopters of improved melon processing technology and its implication on their well-being in Niger State, Nigeria. Specific objectives were to:

1. estimate the economic returns of adopters and non-adopters of improved melon processing technology in the study area
2. compare the well-being of adopters and non-adopters of improved melon processing technology in the study area

The study's hypothesis stated that there is no significant difference between the economic returns and well-being of adopters and non-adopters in the study area.

METHODOLOGY

Niger State is one of the six States in North Central Nigeria, and its population was 4,082,558 (National Population Census (NPC), 2006). The state was created in 1976 with its capital in Minna. Currently, the state covers a total land area of 76,000km² (about 9 percent of Nigeria's total land area). This makes it the largest state in the country (Community Portal of Nigeria, 2003). By reason of its location and its climate, soil, and hydrology, Niger State has the capacity to produce most of Nigeria's staple crops such as maize, sorghum, rice, yam, pepper and melon.

A multistage sampling procedure was used in selecting respondents for this study. There are twenty-five (25) LGAs with 274 wards in Niger State. First Stage involved purposive selection of three Local Government Areas (Lapai, Chata and Agaie LGAs) where melon is being predominantly produced as the major crop. In the second stage, simple random sampling technique was used to select two wards in the selected LGAs in Niger State, making total of six (6) wards selected for the study. Two villages were randomly selected from each of the wards making 12 villages from where empirical data were collected. In the fourth stage, simple random selection of 30% melon processors/marketers was made from each of the selected villages through the data collated by the Federal Ministry of Agriculture and Rural Development (FMARD) and Niger State Agricultural Development Project (NSADP) during the national farmers' registration exercise. There are five hundred and forty-three (543) melon processors which were stratified into 372 adopters and 171 non-adopters. Proportionate sampling of 35% was made from each stratum to give 130 adopters and 60 non-adopters. This gave a total sample size of one hundred and ninety (190) melon processors which was used for this study. The respondents were reached through the *maigari* (community leaders) and contacts of their association leaders.

The most straightforward depiction of a monetary flow would be to look at the sales made in the melon processing and marketing activities, providing an estimation of the earnings of the shelled melon. This was measured in Naira (₦) at ratio level. The economic return of melon processing was estimated using the budgetary analysis. The budgetary analysis involves deduction of total variable costs (in Naira) from the total revenue to obtain the gross margin for the manually and mechanically shelled melon. Total revenue was estimated as the weekly sales made from melon. Costs incurred on processing and marketing was measured in Naira (₦). The total variable cost includes transportation, market levy and miscellaneous. Gross Margin (GM) was used to estimate the profitability.

$$GM = TR - TVC$$

where;

TR – Sales made from shelled melon seeds

TVC – Total Variable Cost

Well-being was measured as ability of the rural women to cater for their basic needs through the proceeds obtained from sales of shelled melon. The basic needs considered were household feeding, health care, children’s education, savings to thrift and cooperatives and personal relationship and charity. This is in line with the Nigeria National Core Welfare Indicators (CWIQ) (NBS, 2006). Data obtained were analysed using t-test.

RESULTS AND DISCUSSION

Economic returns of adopters and non-adopters of improved melon processing technology

The economic returns for melon shelled with hands and melon sheller are presented in Table 1. The average market price of hand shelled melon was ₦500.00/mudu while the one from melon sheller was ₦450.00/mudu. Similarly, average output of melon shelled with hands and melon sheller was approximately 12 mudus/week and 300 mudus/week respectively. The total variable cost incurred on hand shelled melon was ₦3,769.99/week while that of melon sheller was ₦87,570.00/week. The estimated total revenue for hand shelled melon was ₦6,000/week while it was ₦135,000/week for melon sheller. Meanwhile, the

Gross Margin (GM) estimated for hand shelled melon was ₦2,230.01/week compare to ₦47,530.00/week obtained from melon sheller. Adopters of improved technology earned higher economic returns than non-adopters. This implies that adoption of improved technology has impacted positively on the economic returns of melon processors, thereby increasing their probability of escaping economic hardship and poverty. This is in line with the findings of Fadilah *et al.* 2013 that productivity-enhancing agricultural innovations can contribute to raising incomes of rural households, poverty alleviation, food security and better well-being in developing countries. A cross-country study of African countries by Terlin (2003) cited in Nwanyanwu *et al.* (2014) found that monthly income generated in over 18 countries adopting modernized agricultural practices was 40% more than those practicing traditional methods of farming. Ezeh and Nwachukwu (2007) in their study of the impact of selected rural development programmes on poverty alleviation in Abia State, Nigeria found that the participating farmers performed better in terms of income and output compared to their non-participant counterparts. Therefore, improvement in economic returns will further encourage adoption of introduced modern processing technology by the melon processors and marketers.

Table 1: Estimation of economic returns using budgetary analysis technique

Shelled melon (kernels)	Non-Adopters (₦500/mudu)	Adopters (₦450/mudu)
Variable cost (₦)		
Qty unshelled melon (mudus/five days)	24	600 (10 bags)
Purchase (unshelled melon @ ₦8,000/bag)	3,199.99	80,000.00
Market levy	50.00	50.00
Petrol/diesel and oil	0	2,400.00
Labour (wages)	0	2000.00
Transportation	270.00	1,320.00
Miscellaneous	250.00	1700.00
Total Variable Cost (TVC)	3,769.99	87,570.00
Revenue (₦)		
Average output (mudus/every five days)	12	300 (5bags)
Total sales of shelled melon (TR)	6,000.00	135,000.00
Gross Margin (GM = TR – TVC)	2,230.01	47,530.00

Source: Field Survey, 2016

1 mudu of shelled melon approximately weighed 1.26kg

Well-being of adopters and non-adopters
Household Feeding

From the result in Figure 1, all the respondents (100%) indicated that melon contributes to household food security as food condiment along with other food items like *masara*, *chikafa* while returns obtained from melon are used to purchase other food stuff like rice, beans, corns, dry fish and the like. According to Ajani (2008) rural women provide up to 60 to 80 percent of domestic food consumption. However, majority (65.30%) of adopters spent more than ₦5,000/month to purchase food stuff while only very few (6.0%) of non-adopters spent between ₦3,000 – 4000/month

on food stuff depending on the household size. The results uphold the findings of Ampadu-Ameyaw and Omari (2015) that rural women involvement in agro-processing enables the processors to provide the food requirements of the household members and thereby helping such households to escape hunger and poverty, which is becoming endemic in some African countries. IFAD (2012) described women as the principal, if not sole economic support for themselves and for their children. This implies that they are responsible for food security and nutritional well-being of their families (Omonona and Agoi, 2007).

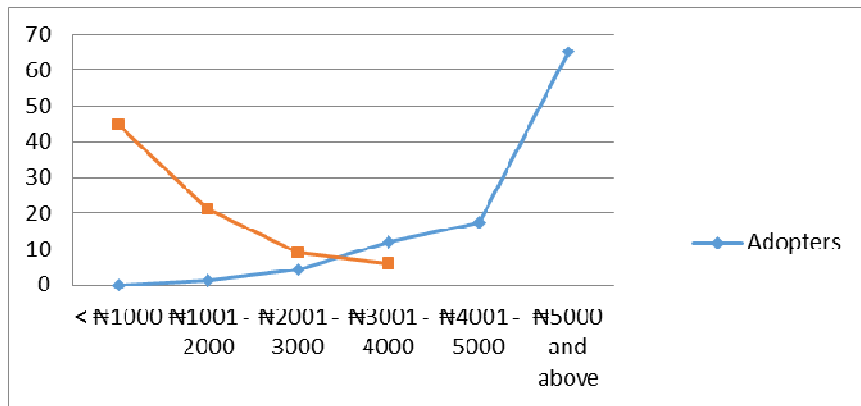


Figure 1: Graph showing contribution to household feeding
 Source: Field Survey, 2016

Health care - The availability of health care services such as primary health care centres, maternity facilities, hospitals and pharmacies, basic health care workers, nurses, midwives, doctors and traditional healers, and other medical services and the use of these services by rural households are indicators of well-being and measures of good health (Oladimeji, 2015). All the adopters (100%) indicated that they spent about ₦200 – ₦1,000 to buy drugs and supplements, and that they paid medical bill of their households up to ₦3,000 and above depending on the nature of illness when they go to hospital for treatment. Meanwhile, most (54.0%) of the non-adopters reported that they spent ₦200 – ₦1,000 on drugs, while 9.30% could

afford ₦1,000 – ₦2,000 when they visit hospitals for treatment. This implies that irrespective of technology status of the melon processors they all attend to their households and personal health needs but the adopters can afford to spend more on drugs and pay higher medical bills going by their production size and economic returns which is higher when compared to the non-adopters. The finding however contradicts submission by Etim and Ukoha (2010) who obtained a value of ₦1,134.34/month for health expenditure of rural households in Akwa Ibom State. Fujitsu (2008) stated that people today have higher expectations of modern health care than they did before so, they spend more to access it.

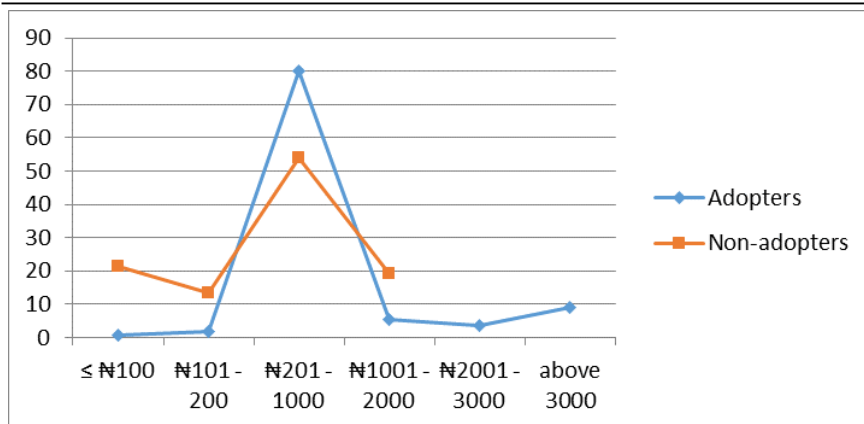


Figure 2: Graph showing contribution to health care
Source: Field Survey, 2016

Children’s education - Almost all (98.90%) adopters spent between ₦2,500 – ₦12,000/session to buy books, school uniforms and sandals for their children, out of which 71.80% stated that they pay the children school fees (₦4000 – ₦5000) to assist their husbands. On the other hand, most (93.70%) of non-adopters spent between ₦1,500 – ₦3,000 on their wards school kits, while 6.30% claimed that they pay their wards school fees (₦3000 - 4000). This implies that melon processing and marketing

activities are major contributor of funds for the education needs of the respondents’ wards. However, the adopters could afford to contribute more funds to cater for their children education than non-adopters. Generally, the women prioritize their children’s education over other social activities. Various studies also show that in rural area women are able to meet their children’s education need first by paying school fees (Ampadu-Ameyaw and Omari, 2015).

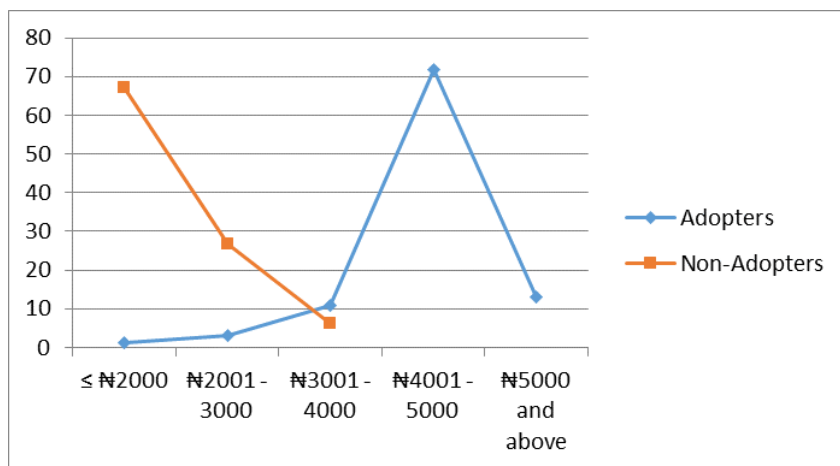


Figure 3: Graph showing contribution to children’s education
Source: Field Survey, 2016

Savings to thrift and cooperatives - About one hundred percent (99.50%) of the adopters reported that economic return from melon is improving because they made appreciable savings up to ₦2,000 – ₦10,000 weekly depending on the demand trend. Adeyemo and Bamire (2005) stated that savings are of great importance in developing world as it has direct bearing on the level of economic activities of the country. It is capable of improving income which is a major poverty index in the rural areas. Study by Fasoranti (2007) also showed that savings mobilization is positively related to investment, asset acquisition, human

development and personal income in the rural areas. With regards to non-adopter only very few (3.50%) mentioned that economic return was favourable and saved between ₦3000 – 4000/week, while majority (96.50%) argued that return is not consistent and as such they could not save much money (less than ₦3000/week). This implies that adoption of improved technology has contributed to consistence and increase in savings for adopters. The more outputs produced, the higher the income generated by the melon processors. In the same vein, higher income depicts higher profit which is expected to be ploughed back into the processing

and marketing of melon by the rural women, by purchasing additional inputs for the subsequent processing and business expansion. The implication here is that rural savings tend to improve the living standard of the rural women in the study area in terms of its contributions to financial strength of the rural women and expansion of their melon processing and marketing activities. Rural savings have become a back bone of rural development given that accessibility to the capital market and formal financial sectors is quite

limited (Fasoranti, 2013). Rural savings among women could be in different forms such important ones are rotating savings (*Esusu*), daily contribution (*Ajo*), cooperative thrifts and credit societies (*Alajeseku*). These informal financial sectors have been found more effective than the formal financial sector since credit facilities from the informal sectors are often accompanied by high interest rates thereby making investment unprofitable.

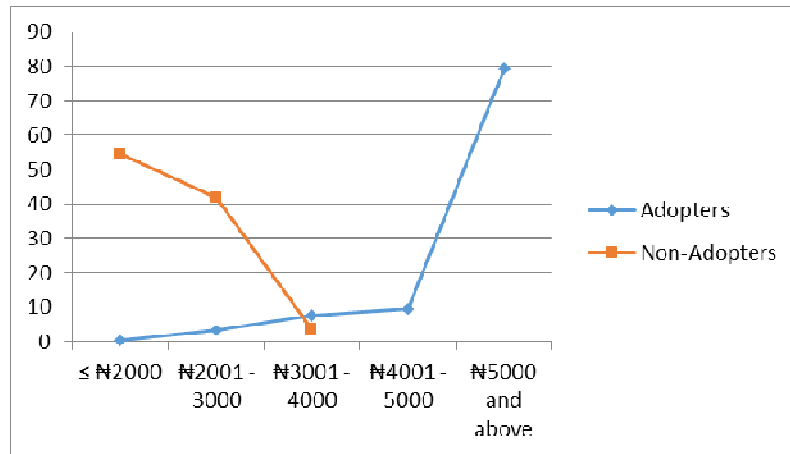


Figure 4: Graph showing contribution to weekly savings
 Source: Field Survey, 2016

Personal relationship and charity

Social relationships have long been considered as one of the strongest and most important predictors of well-being (Argyle, 2001). This assumption is in accord with the arguments of numerous scholars regarding the importance of group living and interpersonal relationships in shaping human evolution (Taylor, 2010). The findings show that both the adopters and non-adopters (100%) relate well with their neighbours but 52.60% of adopters said they had friends they

could support with ₦300 and above as charity. In contrast, 10.50% of non-adopters stated that they could support their friends with up to ₦50 and ₦200 if the need arises. This implies that there is cordial relationship between the melon processors and their neighbours which signifies peaceful co-existence and better well-being. Examples of empirical support from family, friends, and especially from a significant other is tied to greater well-being (Walen and Lachman, 2000; Gallagher and Vella-Brodrick, 2008).

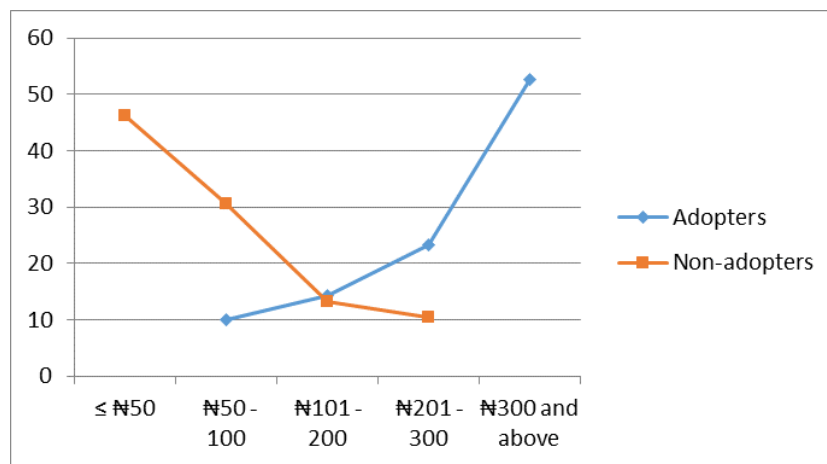


Figure 5: Graph showing contribution to personal relationship
 Source: Field Survey, 2016

Test of hypotheses

Difference between the economic returns of adopters and non-adopters

Results of t-test revealed that there is a significance difference between the economic returns of adopters and non-adopters in the study area ($t = -42.38, p = 0.00$) at $p < 0.05$ level of significance. Adopters realised higher economic

returns compared to non-adopters. The higher economic returns of adopters are attributed to increased output obtained from improved melon processing technology. The null hypothesis that “*there is no significant difference between the economic returns adopters and non-adopters in the study area*” is rejected.

Table 12: t-test result of significant difference between the economic returns of adopters and non-adopters

Economic returns	Sample size	df	Mean	Std. Dev.	Std. Error	Mean diff.	t	p-value	Decision
Non-Adopters	60	59	2807.3	5.59	0.65	-4859.4	-42.38	0.00	S
Adopters	130	129	7666.7	1.98	0.22				

Source: Field Survey, 2016. S - Significant at $p < 0.05$ level of significance

Difference between the well-being of adopters and non-adopters

Results of the t-test show that significant difference existed between the economic returns and well-being of adopters and non-adopters in the study area ($t = -57.4, p = 0.00$) at $p < 0.05$ level of significance. The negative sign indicates an inverse relationship between the well-being of Adopters and Non-adopters. It can be inferred that a better well-being is as a result of increased productivity and economic returns of adopters through

improved technology which has enhanced their ability to meet basic household needs than their counterpart non-adopters. This supports the position of Grabowski and Self (2006) increased agricultural productivity is central to growth, income distribution, improved food security and alleviation of poverty in rural Africa. Therefore, the null hypothesis that “*there is no significant difference between the well-being of adopters and non-adopters in the study area*” is rejected.

Table 13: t-test result of significant difference between the well-being of adopters and non-adopters

Well-being	Sample size	df	Mean	Std. Dev.	Std. Error	Mean diff.	t	p-value	Decision
Non-Adopters	60	59	1.88	0.58	0.08	-194.7	-57.4	0.00	S
Adopters	130	129	196.7	26.3	3.34				

Source: Field Survey, 2016. S - Significant at $p < 0.05$ level of significance

CONCLUSION

Gross Margin (GM) obtained from sales of shelled melon seeds by adopters of improved melon processing technology was higher than that of non-adopters. Hence, higher economic returns realised from improved melon technology contributed more to the meeting of basic needs of the adopters than their counterpart, non-adopters in terms of household feeding, health care, children’s education, financial savings, and personal relationship. Also, t-test results indicated that significant differences existed between economic returns and well-being of the adopters and non-adopters in the study area.

2. Extension agents should be proactive in disseminating innovative information to the melon processors in order to promote further adoption of improved melon processing technology among the rural women.
3. The melon processors’ associations should be seen as a platform to encourage more women to adopt melon shelling innovations in the study area.

RECOMMENDATIONS

This study therefore recommends that:

1. Rural women should continue to adopt improved melon processing technology rather than manual method to enhance their productivity.

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Gender differentials in the accessibility of farm inputs among arable crop farmers in Oyo state, Nigeria

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Abstract: The study assessed gender differentials in the accessibility of farm inputs among arable crop farmers in Oyo State, Nigeria. A two-stage sampling technique was used to select two hundred and ten (210), farmers. Descriptive statistics was used to present the data and inferential statistics was used for data analysis. Male respondents have more access to farm inputs such as inorganic fertilizers (99.0%), while the female farmers had more of storage facilities (89.5%). Major constraints affecting access to farm input among the male farmers were inadequate extension contacts, (96.2%) while among the female farmers lack of capital (94.3%), was a major constrain. Access to farm inputs was significantly influenced by household size (0.050), years of education (0.371) and years of farming (0.768) while for female farmers it was age (0.047), household size (0.384), years of education (-0.312) and membership in farmers association (0.008). Female farmers were found to have poor access to farm inputs than their male counterparts. There is need for policy to address improved access to farm inputs for farmers and also extension agencies should disseminate adequate information on channels for farm inputs among both genders.

Keywords: Gender, farm inputs, accessibility, differentials, farmers

INTRODUCTION

Farming is an income-generating business which contributes significantly to the economy of any country. An estimated 76 % of Nigeria's population lives in the rural area and Agriculture remains the primary source of livelihood for these rural dwellers Otekhile and Verter (2017). This indicates that the growth of Agricultural sector has direct impact on the welfare of the rural dwellers hence it is imperative to look critically into the type and source of inputs which determines the outputs i.e. the yield of their farm business. Rahji and Fakayode, (2009) also confirms Agriculture as a major sector in the economy that contributes enormously to Nigeria's GDP. Agricultural sector can be referred to as Mother of all sector owing to the fact that all the other sectors directly or indirectly depend on agriculture either for food to sustain their workforces or as crucial input in their production process Yusuf (2014).

However, considering the vital roles the Agricultural sector plays at household and national level, input supply is a factor that is key to sustain Agriculture. Farm inputs can be described a range of materials used to enhance agricultural productivity, most important among these are fertilizers, improved seeds, storage and harvest facilities The use of farm inputs is fundamental to agriculture in developing countries such as Nigeria and also for the sustainability of Agriculture, farm inputs must be accessible, available and affordable to farmers. For agriculture to prosper, farm inputs need to be available, affordable, accessible, and of good quality. Seeds, fertilizers, and agro-chemicals are essential for improving the productivity and incomes of smallholder farmers in developing countries (World Bank, 2013).

Pauleen, (2017) asserts that Agricultural inputs are great determinant of yields in any type of agricultural production. In the modern world today,

agriculture has become extremely dynamic therefore, making the kind of inputs that are being used in the sector today upgraded. There are two types of inputs according to Scool (2020), the natural or physical inputs and the human inputs. Examples of physical inputs are weather, climate, relief, soil, geology and latitude. Farmers have little or no control over these inputs, changes can be sometimes done but it usually involves a lot of expenses. Examples of human inputs include machinery, fertilizers, pesticides, seeds, government influence, livestock, animal feed, workers and other facilities, they are usually paid for.

However, gender differences, arising from the socially constructed relationship between men and women affect the distributions of agricultural resources and may cause disparities in the farmers having access to farm inputs and may likely affect their farm outputs. It is worth noting that the rights, responsibilities and opportunities of individuals should not be determined by the fact of being born male or female. In other words, it is a point when both men and women realize their full potential. Also, men and women share many responsibilities and engage in different production system, different needs and constraints relating to their farm activities. Men and women continue to have differential access to agricultural resources despite the seemingly equal roles they play in agriculture in many developing countries, they both contributes significantly to agricultural production, yet their access to agricultural resources differ [Food and Agricultural Organisation (FAO) (2010)]

Several researches have observed that in agricultural production, women are more constrained than their male counterparts as a result of which most women have less access to and higher effective costs for information technology,

inputs and credit (Shultz, 2007 and Yemisi et al. 2009). It has been assumed that if the income of women increased they may have more access to resources and invest in their children's education, health care and nutrition. However, they are constrained by poor access to resources, poor educational background, and poor network and mobility restrictions. However, farm inputs are great determinants of yields in any type of agricultural production (Yengoh, 2012; McAuthur, 2017; Pauleen 2017). (No source). Considering the established disparity in access to production inputs between male and female farmers.

Although both male and female are involved in agricultural production, the level of accessibility to farm inputs in the study area is undermined. The study therefore, examined farmers' accessibility to farm inputs among male and female farmers in Oyo State, Nigeria. The specific objectives were to; describe the socio-economic characteristics of the male and female farmers; determine the level of access of male and female farmers to Farm inputs and identify the constraints to access of farm inputs to male and female farmers,

The hypothesis stated that there is no significant relationship between some selected socioeconomic characteristics of the male and female farmers' and access to farm inputs.

METHODOLOGY

The study was carried out in Oyo state which is predominantly agrarian with about 70 percent rural population. The land covers a vast area of 32,249.10 square kilometres out of which 27,107.93 km is cultivable Oyo State Agricultural Development Programme, (2001). Oyo State has 33 Local Government Areas. The main occupation of majority of the people in the study area is farm as is typical of any rural area in Sub-Saharan Africa (SSA) Oyo State Agricultural Development Programme, (2001). The major crops grown in the study area include maize, yam, cassava, cocoyam, vegetables (such as okra, melon, tomatoes, and pepper), plantain, banana, cocoa, oil palm and rubber. Some of the inhabitants also engage in other income generating activities like trading, processing, marketing of agricultural produce and handicraft.

A two-stage sampling technique was used for the selection of the respondents. The first stage involved a random selection of 20% out of the 33 LGA in Oyo state giving a total of 7 LGAs which includes: Surulere, Ibarapa, Akinyele, Ogbomosho North, Ogbomosho South, Afijio and Saki west Local Government Areas. The second stage involved random selection of one village from each of the selected Local Government Areas. In each village, thirty (30) farming households were selected among the farming households in the selected Local Government Areas consisting of

fifteen male and fifteen female farming households to make up a sample size of two hundred and ten respondents (210). Justification for the use of 30 farming household was to achieve a manageable size while ensuring equitable distribution among respondents. Data collected were analyzed with descriptive statistics such as frequency, percentages and mean while linear regression was used to analyze the data.

The level of accessibility of male and female farmers to farm inputs, it was measured on a four (4) point Likert type scale of Very accessible (3), Accessible (2), Fairly accessible (1) and Not accessible (0). These values were summed up to obtain 6 and was further divided by 4 to get 1.5. Variables with the mean equal or greater than 1.5 was considered as good access to farm inputs while variables with mean lower than 1,5 was considered as poor access to by the farmers (Okunade,2007). Also, for further categorisation of accessibility of farm inputs, respondents were asked to indicate their choices among the farm inputs presented to them. For the ten (10) farm inputs that was presented, any respondents that had access to (6) six farm inputs and above is regarded as having high level of accessibility to farm inputs while any respondents that have less than six inputs is categorized as low access to farm inputs. To identify constraints, respondents were asked to tick "yes or no" against a list of possible constraints applicable to them.

A linear regression analysis was used to determine socioeconomic factors influencing farmers' access to farm inputs. Regression analysis is useful for determining the relationship between the endogenous and exogenous variables as well as determining the overall effects of all these variables on the endogenous variables.

The linear regression model is specified as;

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \dots + b_7X_7 + u_i$$

Where

Y= access to farm inputs among male and female farmers

Where

b₀ = Constant

X₁=Age of the respondent (Actual age in years)

X₂= Marital status (dummy)

X₃=Household size (Actual number of members of the household)

X₄= Years of schooling (Actual years spent in school in years)

X₅=Size of cultivated land (hectares)

X₆= Farming experience (Actual farming experience in years)

X₇= Membership of association (member = 1; Non-member of association =0)

u_i= error term

RESULTS AND DISCUSSION

Socioeconomic characteristics of respondents

Results on table 1 revealed that the mean age of male and female farmers were 42.8 and 40.7 years respectively which denotes an active and economical age group. About 91.4% of the male farmers and 77.1 % of the female farmers were married. Also, the mean household size for male and female farmers were 9 and 11 persons respectively, which indicates a relatively large household size that implies likely increased availability of family labour on various agricultural production activities by the farmers. The mean years of schooling for the male and female farmers were 11.4 and 8.8 years respectively. This implies that most of the farmers were literate at various levels and it was further revealed that the mean

total size of cultivated land for male farmers was 2.2 hectares while that of their female counterparts was 1.3 hectares. This results agrees with the findings of Daudu et al. (2016) that male farmers have farm size larger than their female counterparts and could be attributed to the fact that female farmers may be engaged in other business that is fetching them extra income. Kayode et al (2017) also reported that both men and women are small scale farmers practicing on small acreage of land. Years of farming experience for both male and female farmers were found to be 18 and 13 years respectively. Also, 69.5% of the male farmers claimed they were members of farmers' organisation and 64.8% of the female were also members of farmers' organisation

Table 1: Distribution of socio-economic characteristics of the male and female arable crop farmers

Socioeconomic characteristics	Male		Mean	Female		Mean
	Frequency	Percentage		Frequency	Percentage	
Age (Years)						
≤ 30	28	26.7		23	21.9	
31-50	49	46.7	42.8	60	57.1	40.7
Above 50	28	26.7		22	20.9	
Marital status						
Married	96	91.4		81	77.1	
Divorce	0	0		13	12.4	
Widowed	9	8.6		11	10.5	
Household size (Person)						
1-3	26	24.8		17	16.2	
4-6	47	44.8	9.1	45	42.9	11.3
Above 6	32	30.5		43	40.9	
Years of schooling						
0	15	14.2		20	19.0	
1-6	30	28.6	11.4	43	40.9	8.8
6-12	38	36.2		28	27.6	
Above 12	22	20.9		14	13.3	
Size of Cultivated land (ha)						
< 1	24	22.9		58	55.2	
1-2.99	52	49.5	2.2	37	35.2	1.3
3-4.99	22	20.9		10	9.5	
≥5	7	6.6		0	0	
Farming experience (Years)						
≤ 10	19	18.1		76	72.3	
11-20	64	60.9	18.4	21	20.0	13.9
Above 20	22	21.0		8	7.6	
Membership of farmers' cooperative society						
Yes	73	69.5		68	64.8	
No	32	30.5		37	35.2	

Source: Field Survey (2018)

Accessibility of male and female farmers to farm inputs

The results on table 2 showed ranking of the accessibility of male and female farmers to farm inputs in the study area and based on the mean score of 1.5 It was revealed that male farmers have more access to farm inputs such as inorganic

fertilizer (WMS=2.28), pesticides (WMS= 2.11), herbicides (WMS= 2.06), land (WMS= 1.77) Varieties of root and tuber crops (WMS=1.70) Improve varieties of seed and Harvest facilities had (WMS= 1.57) each while among the female farmers, farm inputs such as pesticides (WMS= 2.53), harvest facilities (WMS= 2.36) Herbicides

(WMS = 2.22), Inorganic Fertilizer (WMS= 1.93) and Varieties of root and tuber crops (WMS= 1.63) were easily accessible among the female folks.

This result implies that both male and female farmers have relatively equal access to some farm inputs while access to farm inputs such as land and improved varieties of seeds are still limited among the female farmers. This result is in tandem with

the findings of Okonya (2014) that factors such as culture, tradition, gender roles and responsibilities could affect access of women to agricultural information and farm inputs. It was also noted that the male farmers had better access to inputs that has to do with production, management of pest and diseases while the female farmers had better access to storage facilities and harvest facilities.

Table 2: Rank order of accessibility of farm inputs among the male and female farmers

Farm inputs	Male (n=105)		Female (n=105)	
	WMS	Rank	WMS	Rank
Inorganic fertilizers	2.28	1 st	1.93	4 th
Organic Fertilizers	1.42	8 th	0.38	10 th
Improved varieties of seeds	1.57	6 th	0.84	7 th
Farm machines	1.04	9 th	0.88	6 th
Pesticides	2.11	2 nd	2.53	1 st
Land	1.77	4 th	0.42	9 th
Harvest Facilities	1.57	6 th	2.36	2 nd
Herbicides	2.06	3 rd	2.22	3 rd
Varieties of root and tuber crops	1.70	5 th	1.63	5 th
Storage facilities	0.40	10 th	0.73	8 th

Source: Field Survey (2018) *Mean =1.5
WMS= Weighted Mean Score

Level of Accessibility to Farm inputs

Table 3 further shows level of accessibility to farm inputs. For the ten farm inputs that was presented, any respondents that had access to six farm inputs and above is regarded as having high level of accessibility to farm inputs while any respondents that have less than six inputs is

categorized as low access to farm inputs, Based on this, 78.6% of the male farmers have high access to farm inputs while 21.4% had low access to farm inputs. Among the female respondents, 61.9% had high access to farm inputs while 38.9% had low access to farm inputs.

Table 3: Distribution of Male and Female Farmers by Level of Accessibility to Farm Input

Level of Accessibility	Percentages		Mean score
	Male	Female	
High	78.6	61.9	6
Low	21.4	38.9	
Total	100	100	

Source: Field Survey (2018)

Constraints to accessibility of farm inputs by the male and female arable crop farmers

The results as presented in table 34 shows the constraints to accessibility to farm inputs among the respondents. Inadequate extension agents contact (96.2%), improper understanding of the farm inputs (Technical Know-how) (92.4%), lack of capital (91.4%) and high cost of farm inputs (85.7%) were major constraints among the male farmers while among the female farmers, lack of capital (94.3%), High cost of transportation

(82.8%), inadequate extension agents contact (76.2%) and cultural beliefs (74.3%) were common factors that influenced their access to farm inputs This is evidenced by the fact that inadequate extension agent contact was a factor that influenced access to farm inputs among the male and female farmers. This implies that there is need for extension agents to intensify efforts on sensitizing the farmers on the uses of appropriate farm inputs on the farms in the study area in order to maximize their outputs.

Table 4: Constraints to accessibility of farm inputs by male and female farmers,

Constraints	Male (n=105)		Female (n=105)	
	Frequency	Percentage	Frequency	Percentage
Lack of capital	96	91.4	99	94.3
Cultural beliefs	23	21.9	78	74.3
Weather	25	23.8	32	30.5
High cost Transportation	35	33.3	87	82.8
Inadequate extension agents contact	101	96.2	80	76.2
Improper understanding of Farm inputs (Technical Know-how)	97	92.4	54	51.4
Presence of pest	70	66.7	59	56.2
High cost of farm inputs	90	85.7	76	72.4
Age related problems	50	47.6	83	79.0

Source: Field Survey (2018)

*Multiple responses

Test of Hypothesis

Results on table 5 shows that among the male farmers, household size ($r = 0.050$), education ($r = 0.371$) and years of farming experience ($r = 0.768$) has a significant relationship with level of access to farm inputs This implies that families with more members will likely have more access to farm inputs than smaller household size. Also, the positive nature of the relationship between education ($r = 0.371$), years of farming experience ($r = 0.768$) and level of access to farm input indicates that male farmers with a higher level of education and those with more years of farming experience were likely to have more access to farm inputs. This finding is consistent with report of Omotesho *et al* (2019).

In the female category, significant relationship exists between age ($r = 0.047$), household size ($r = 0.384$), farmers' association ($r = 0.008$) and level of access to farm input. This implies that the older female farmers are more likely to have access to farm input than the younger ones. This finding corroborate with Ango *et al.* (2014) who confirmed that there is significant relationship between age of

the farmers and access to farm inputs. Also the positive relationship between farmers association and level of access to farm inputs implies that women farmers in association are more likely they have access to farming inputs than those who do not join farmers association. This is in line with the findings of Nazaki (2017) who reported that women farmers' participation in farmers association is a great step towards their empowerment and a key towards improved output by having better access to input opportunities. On the other hand, the inverse relationship between education ($r = -0.312$) and level of access to farm inputs among female farmers contradict a *priori* expectation that that the educated farmers may have more access to farm inputs due to the fact that education has been reported to be crucial effect on farmers ability to adopt innovations. This result implies that the literate women may not be interested in farming activities in the study area. The R^2 values of 0.5543 (Male) and 0.5431 (Female) explains the variation in their level of access to farm inputs.

Table 5: Result of regression showing relationship between selected socioeconomic characteristics of male and female farmers and level of access to farm inputs

Socioeconomic characteristics	Male (n=105)			Female (n=105)		
	Regression co-efficient	Standard error	p-value	Regression co-efficient	Standard error	p-value
Age	2.503	2.247	0.653	0.047	0.183	0.003*
Household size	0.050	0.023	0.005**	0.384	0.216	0.001*
Extension visits	2.267	1.234	0.399	2.895	2.361	0.294
Education	0.371	0.140	0.000*	-0.312	0.03	0.005**
Farm size	0.300	0.190	0.026	0.715	0.344	0.790
Years of farming experience	0.768	0.117	0.002*	0.035	1.904	0.276
Farmers association	2.783	0.711	0.843	0.008	0.022	0.024**

Male Female

$R^2 = 0.5543$ $R^2 = 0.5431$

F Value =1.91 F Value=1.94

Source: Field Survey (2018)

** Significant at 5%

*Significant at 1%

CONCLUSION AND RECOMMENDATIONS

The study concluded that although both male and female farmers have access to farm inputs, more females have low access to farm inputs than their male counterparts. Inadequate contact of extension agents was a common constraint among both gender. Access to farm inputs for male farmers was influenced by household size, education, years of farming experience and while that of female was influenced by age, household size, education and farmers' association influences their access to farm inputs in the study area. Based on these findings it was recommended that extension agents should be available to the male and female farmers and disseminate information on accurate knowledge on the accurate use of farm inputs. There is also the need to subsidized farm inputs by the government or stakeholders to make it affordable to both male and female farmers. Also identified gender differences in farm inputs should be considered in policies and other strategies.

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Agricultural-credit needs and utilisation among small-scale fish farmers in Obio-Akpor local government area of Rivers state, Nigeria

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Abstract: The study examined micro-credit needs and utilisation among small-scale fish farmers in Obio-Akpor Local Government Area of Rivers State, Nigeria. The objectives were to: investigate types of pond system used in the study area; identify the area of micro-credit utilisation among the farmers; identify the micro-credit needs of small-scale fish farmers; and determine socio economic determinants of micro credit utilisation. Data were collected through the use of a questionnaire. A total of nineteen (19) respondents were used, seventeen (17) were the fish farmers selected from six communities and two (2) were the micro-credit banks. Data were analyzed with the use of frequency, percentage, mean scores and ordinary least square (OLS) multiple regression. Findings showed that majority (53%) cultured their fish in plastic and concrete ponds, (88%) of the respondents used bore-hole as source of water. Micro-credit was used for the following; increase in farm size (\bar{x} =4.9), Purchase of new fishing equipment (\bar{x} =4.9), Purchase feeds (\bar{x} =4.9), Acquire capital assets (\bar{x} =4.7), Pond repair (\bar{x} =3.7) and Payment of labour (\bar{x} =3.6). micro-credit needed for the following; Transport (\bar{x} =4.9), Purchase of fishing tools (\bar{x} =4.9), Meet land clearing needs (\bar{x} =4.8), Boost working capital base (\bar{x} =4.8), Purchase of equipment (\bar{x} =4.7), Meet storage needs (\bar{x} =4.4), Hire labour (\bar{x} =4.1), Servicing and maintenance of capital Equipment (\bar{x} =4.0), consumption needs (\bar{x} =3.5) and Children's school fees (\bar{x} =3.5). The result of the linear regression analysis showed that household size and farming experience were determinants of micro-credit acquisition at $P \leq 0.05$. The study recommended that the credit to farmers need to be increased so that the fish farmers could make greater impact in fish production and increase economic growth in Nigeria

Keywords: Agricultural credit, Needs, Utilisation, small-scale

INTRODUCTION

Fish production in Rivers State is dominated by smallholder producers. Smallholder fish production is broadly characterized as a dynamic and evolving sub-sector that is employing labour-intensive harvesting, processing and distribution technologies to exploit marine and inland water resources (FAO, 2005; Bene, 2006). The activities of this sub-sector, conducted full-time, part-time or just seasonally, are often targeted at supplying fish and fisheries products to local and domestic markets, as well as for subsistence consumption (FAO, 2005; Bene, 2006; Bene *et al.*, 2007). Within the Smallholder fish farmers are those who produce with stocking capacity of less than 2000 fingerlings (Federal Office of Statistics, 1999; Omitoyin, 2007). Small scale fish farming in Nigeria is practiced under four major systems: extensive, semi-intensive, integrated and intensive. The extensive system, according to Omitoyin (2007) and Nwike (2002), small scale fish farming is characterized by low stocking density, low production with little or no nutritional inputs and low investment cost. In the semi-intensive culture system, fish is stocked at a higher stocking density than the extensive system and fed with supplementary feed to support the natural food supply (Ozigbo, Anyadike, Adegbite, and Kolawole, 2014). There is usually pond fertilization to increase the nutrient requirements in the semi-intensive culture system in case of earthen pond. Its production cost is usually moderate, and its yield is higher than the case in the extensive

system - above 10,000kg/ha/year (Omitoyin, 2007). The integrated system is the culture of fish alongside other forms of agriculture. It is a farming system where resources are efficiently utilised and recycled to achieve higher production than would be obtained from a single production system (Otubusin, 1994). Devendra (1995) viewed integrated fish farming as a multiple land-use approach which combines fish farming with other agricultural (crops and animals) production systems. On the other hand, intensive fish culture system is one where fishes are stocked at a high density and fed exclusively on a nutritionally-balanced diet to meet their nutrient requirements (Ozigbo *et al.*, 2014). The cost of production is high, and the yield is also very high.

Small-scale fish farmers need micro-credit to purchase fingerlings, fertilizers, agro chemicals, payment for labour cost, transportation and feed. Money is also needed to run the day to day transactions in the farming business and to feed the family. Anyanwu and Anyanwu (2003) observed that small-scale farmers are poor and cannot afford to acquire these modern inputs for their production. This is why the small-scale fish farmers need to acquire micro-credit to carry out their operations. However, the access of these farmers to micro-credit is daunting. How these farmers acquire micro-credit for their production activities is a problem.

The usefulness of any agricultural credit programme does not only depend on its availability, accessibility and affordability but also

on its efficient allocation and utilisation for intended purposes beneficiaries. Oboh, Nagarajiam and Ekpelu (2011) in their study of a marginal analysis of agricultural credit allocation by arable crop farmers in Benue State, Nigeria. From the aforementioned there is the need to raise the necessary capital for fish farming. Anyanwu also observed that farmers do not often receive much financial assistance from relations, friends or neighbours as these people are generally poor. Herbert (2001) identifies both informal or non-institutional and formal or institutional credit to farmers. In Nigeria, informal source of credit available to small-scale fish farmers can be divided into financial self-help groups and individual financial self-help associations and other development oriented self-help groups in which financial functions are normally secondary (Kropp, *et al* 1989). The most widespread and most important financial self-help or mutual aid associations are the savings and credit associations (Seibel and Darnachi, 1982; Seibel and Max, 1987; Nweze, 1990). These can also be further divided into rotating and non-rotating associations and association with and without a loan scheme.

Objectives of the study

The objectives of the study were to;

1. investigate types of pond system used in the study area;
2. identify the area of micro-credit utilisation among the farmers;
3. identify the micro-credit needs of small-scale fish farmers; and
4. determine socio economic determinants of micro credit utilisation

Material and Methods

This study was carried out in Obio-Akpor Local Government Area (LGA), Rivers State, Nigeria. This area is the South-South region of Nigeria, otherwise known as Niger Delta Region. It is located between latitudes 445°E and 460°E and longitudes 650°E and 800°E (Eludoyin *et al*, 2011). Obio-Akpor LGA is sharing boundary with Etche LGA on the North, Port-Harcourt LGA on the South, Ikwerre LGA and Emuoha LGA on the East, Oyigbo LGA and Eleme LGA on the West. The people are predominantly farmers, traders and artisans.

The population of the study constitutes all registered fish farmers and micro-finance institutions and informal sources of credit in Obio-Akpor Local Government of Rivers State, Nigeria.

The Nigerian National Bureau of Statistics gave the population census in 2006 of the LGA to be 464,789. According to Rivers State Ministry of Agriculture, there are seventeen (17) registered contact fish farmers in Obio-Akpor LGA.

The purposive sampling technique was employed for this study. The entire population of seventeen registered fish farmers was used as the sample size. Owing to the small sample size, T-test was used to interpret the result from the analysis.

Data were collected by the researcher through primary source. The instrument for data collection (questionnaire) was divided into two sections. The first information on pond system

Data collected from the respondents were analyzed using descriptive statistics such as table, percentage and frequency, while the t-test statistics was used to test the stated hypotheses at 0.05 level of significance. A five point likert type scales with options; Strongly Agreed (5), Agreed (4), Disagreed (3), Strongly Disagreed (2), and undecided (1) was also used. The values were added make it (15) which was divided by 5 to get 3.00. This served as cut-off point. Multiple Regressive analysis was used as well to determine credit utilisation. Another four point likert type scales with options; strongly agreed (4), agreed (3), disagreed (2) strongly disagreed (1) was also used to evaluate the constraints in micro-credit utilisation among the fish farmers.

The multiple regression model was implicitly specified as follows:

$$Y=f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, \dots, X_n) \dots \dots \dots \text{equ 1}$$

Where; Y= Micro-credit acquisition (Yes = 0; No = 1)

X₁ = Sex (female = 0; male = 1)

X₂ = Age (years)

X₃ = Marital status (married = 1; Otherwise = 0)

X₄ = Household size (persons)

X₅ = Educational level (years in school)

X₆ = Farming experience (years)

X₇ = Annual income (N)

β₀ = Constant

β = Regression coefficient

e = Stochastic error term

Three functional forms of the model – linear, double log and semi log were fitted to determine the function with the best fit and the linear model proved to be the best fit.

Table 4.1 Showed pond information of Fish Farmers in the study area

Variable	Frequency	Percentage (%)
Pond Type		
Plastic	6	35
Concrete	2	12
Fibre/Glass	0	0
Rectangular	0	0
Plastic and Concrete	8	53
Earthen pond	0	0
Stocking Density (m²)		
1-50/m ²	14	82
51-100/m ²	3	18
101-150/m ²	0	0
151-200/m ²	0	0
Number of Ponds		
1 - 5	7	41
6 - 10	8	47
11 - 15	0	0
16 - 20	2	12
Source of Water		
Borehole	15	88
Well	0	0
Rain	0	0
Stream	2	12
Underground	0	0
Time of harvest / year		
Once	0	0
Twice	10	59
Thrice	7	41
Total	17	100

Source: Field Survey, 2020

Rearing facilities of fish farmers

The distribution of fish farmers according to facilities used for rearing fish is presented in Table 4.2. A fraction of the farmers (35%) cultured their fish in plastic ponds, 12% made use of concrete pond. A lot of the fish farmers (53%) cultured their fish in plastic and concrete ponds. None of the fish farmers cultured their fish in earthen pond. This contradicts with the work of Ele *et al.* (2013) on economic analysis of fish farming in Calabar, Nigeria where they reported that earthen pond was mostly preferred by fish farmers in Calabar.

Sources of water

Water is an indispensable input in fish rearing. Fish need water to grow and that is one of the reasons why adequate and constant sources of water is a must for every farmer that wants to achieve the best in terms of raising fish either for fingerling or table size.

The result showed the distributions of the water source used by the respondents (table 4.2). The majority (88%) of the respondent used bore-hole, only few (12%) used stream water.

Well and rain water were not used in the study area. Overall, the percentage distributions for water source were 96 and 4% for bore-hole and well water, respectively. No respondent was recorded for the use of water from river, stream and rainfall.

It might be because bore-hole was more dependable and free of diseases and parasites (Williams *et al.*, 2012).

Utilisation of micro credit by Fish Farmers

Result on Table 4.2 showed that the micro credit acquired was utilised properly. The fish farmers mean response on how they utilise the credit showed that the mean score of each item was above 3.50. This is above the decision cut-off point. This implies that increase in farm size ($\bar{x}=4.9$), Purchase of new fishing equipment ($\bar{x}=4.9$), Purchase feeds ($\bar{x}=4.9$), Acquire capital assets ($\bar{x}=4.7$), Pond repair ($\bar{x}=3.7$) and Payment of labour ($\bar{x}=3.6$) were agreed as ways of utilisation of micro-credit. This shows that the loan had positive effect on the fish farmers' income. Nwagbo (1989) agreed with this fact when he stated that, credit, if well applied, should increase size of farm, productivity and therefore income. It could be stated that in spite of the fact that the financial institution may not have met the expectation of the farmers by moving them to higher economic level, it has contributed in enhancing their productivity and income.

Table 4.2: Response on ways of utilisation of micro credit in the study area

S/N	Utilisation of micro credit (n=17)	SA (5)	A (4)	D (3)	SD (2)	UD (1)	Total Score	Mean Score	Remark
1	Increase my volume of farm size	16	1	0	0	0	84	4.9	Agreed
2	Enable me to acquire new fishing equipment	16	1	0	0	0	84	4.9	Agreed
3	Enable me to acquire capital assets.	15	1	0	0	1	80	4.7	Agreed
4	Payment of labour	0	10	7	0	0	61	3.6	Agreed
5	Purchase of feeds	16	1	0	0	0	84	4.9	Agreed
6	Pond repair	1	11	4	1	0	63	3.7	Agreed

Source: Field survey 2020

Multiple Responses ≥ 3.00 = Agreed; ≤ 3.0 = Disagreed: SA= Strongly Agreed, A= Agreed, D= Disagreed, SD = Strongly Disagreed, UD = Undecided

Micro-Credit Needs of Fish Farmers

Table 4.3 gives a summary of the results of micro-credit needs of farmers in the study area obtained from the field survey. Using a mean score of 3.00 as the decision rule, the result in Tables 4.3 shows that all the micro credit needs in the study area were accepted by the fish farmers. This implies that Transport needs (\bar{x} =4.9), Purchase of fishing tools (\bar{x} =4.9), Meet land clearing needs (\bar{x} =4.8), Boost working capital base (\bar{x} =4.8), Purchase of equipment (\bar{x} =4.7), Meet storage needs (\bar{x} =4.4), Hire labour (\bar{x} =4.1), Servicing and maintenance

of capital Equipment (\bar{x} =4.0), consumption needs (\bar{x} =3.5) and Children’s school fees (\bar{x} =3.5) were agreed as micro-credit needs of fish farmers in the study area.

Most rural farmers often find it very difficult to pay for their children school fees and consumption needs because of the little income they earn. They tend to borrow money so their children will be better in future. This agrees with the study of Ogunfowora *et al.* (1972) who reported that credit is not only needed for farming purposes, but also for family and consumption expenses; especially during the off season period.

Table 4.3: Micro credit needs of fish farmers

S/N	Micro credit needs of fish farmers (n=17)	SA (5)	A (4)	D (3)	SD (2)	UD (1)	Total Score	Mean Score \bar{x}	Remark
1	Transport need	15	2	0	0	0	83	4.9	Agreed
2	Purchase fishing tools	15	2	0	0	0	83	4.9	Agreed
3	Hire labour	4	10	3	0	0	69	4.1	Agreed
4	Meet storage needs	11	5	0	1	0	75	4.4	Agreed
5	Meet land clearing needs	10	6	0	1	0	81	4.8	Agreed
6	Purchase equipment	12	5	0	0	0	80	4.7	Agreed
7	Servicing and maintenance of Equipment	4	10	3	0	0	69	4.0	Agreed
8	Boost working capital base	14	3	0	0	0	82	4.8	Agreed
9	Consumption needs	2	6	8	1	0	60	3.5	Agreed
10	Children’s school fees	2	6	8	1	0	60	3.5	Agreed

Source: Field survey 2020

Multiple Responses ≥ 3.00 =Agreed; ≤ 3.00 =Disagreed. SA= Strongly Agreed, A= Agreed, D= Disagreed, SD = Strongly Disagreed, UD = Undecided

Table 4.4 gives a summary of the results of micro-credit needs of farmers by micro credit institutions in the study area obtained from the field survey. Using a mean score of 3.00 as the decision rule, the result in Tables 4.4 shows that almost all the micro credit needs in the study area were

accepted by the financial institutions. This implies that Purchase inputs (\bar{x} =4.9), Purchase equipment (\bar{x} =5.0), Boost working capital base (\bar{x} =4.5), Meet storage needs (\bar{x} =4.5), Purchase of fishing tools (\bar{x} =4.0), Hire labour (\bar{x} =4.0) and Meet

land clearing needs (\bar{x} =4.0) were agreed as micro-credit needs of fish farmers by financial institutions

in the study area.

Table 4.4: Showed financial institutions response to micro credit needs

S/N	Micro credit needs of fish farmers (n=2)	SA (5)	A (4)	D (3)	SD (2)	UD (1)	Total Score	Mean Score \bar{x}	Remark
1	Purchase inputs	2	0	0	0	0	10	5.0	Agreed
2	Purchase fishing tools	1	0	1	0	0	8	4.0	Agreed
3	Hire labour	0	2	0	0	0	8	4.0	Agreed
4	Meet storage needs	1	1	0	0	0	9	4.5	Agreed
5	Meet land clearing needs	0	1	0	1	0	6	3.0	Agreed
6	Purchase equipment	1	1	0	0	0	10	5.0	Agreed
7	Servicing and maintenance of capital Equipment	0	1	0	1	0	5	2.5	Disagreed
8	Boost working capital base	1	1	0	0	0	9	4.5	Agreed
9	Consumption needs	0	0	1	1	0	5	2.5	Disagreed
10	Children's school fees	0	0	0	2	0	4	2.0	Disagreed

Source: Field survey, 2020

Multiple Responses ≥ 3.00 = Agreed; ≤ 3.00 = Disagreed. SA= Strongly Agreed, A= Agreed, D= Disagreed, SD = Strongly Disagreed, UD = Undecided

Determinants of micro-credit utilisation

The determinants of the respondents' micro-credit acquisition is presented in Table 4.6. The linear regression model has an R-square of 0.941 which implies that about 94% of the determinants of a respondent to acquire micro-credit are strongly explained by the independent variables. Only 16%

was not explained, this was due to stochastic error term.

The result showed that the coefficient of household size and farming experience were statistically significant at 5 percent level.

The following regression equation was built from the lead equation.

Table 4.6 Regression estimates of the socio-economic determinants of micro-credit utilisation

Variable	B	Std. Error	T	Sig.
Constant	.038	.395	.096	.925
Sex	-.284	.151	-1.889	.092
Age	-.112	.220	-.509	.623
Marital Status	.189	.336	.562	.588
Household Size	.571	.206	2.771	.022**
Educational Level	.178	.187	.954	.365
Farming Experience	1.552	.345	4.495	.001**
Annual Income	-.321	.170	-1.886	.092
R ²	0.961			
F-value	31.947			

Source: Field survey, 2020,

Significant at 0.05 significant level

$$Y = 0.038 - 0.284(X_1) - 0.112(X_2) + 0.189(X_3) + 0.571(X_4) + 0.178(X_5) + 1.552(X_6) - 0.321(X_7)$$

The coefficient of educational level and marital status were positive but were not significant. More specifically, the coefficients of sex, age, and annual income were negative.

The finding from the study showed that Sex (X₁) had a coefficient of -0.284, this implies that women had low access to micro-credit compared to men, though it was not significant at 5% probability level. This finding disputed the findings of Kaino (2005) and that of Sebopetji and Belete (2009). However, the finding is consistent with the

findings of Winter-Nelson and Temu (2002) who reported a negative relationship between female headed and liquidity constrained in Tanzania.

Household size (X₄) had a positive coefficient (0.571), which was significant at 5% level. This means that the amount of agricultural credit acquired and household size had direct correlation. This result is also in agreement with priori expectation. As the size of a household increases, the household needs will also increase. In a bid to satisfy the increased household needs, relatively larger amount of loans will be acquired. However, the tendency for diversion of agricultural loan to

consumption purposes also increases with household size.

Farming experience (X_6) was also positive and significant with coefficient of (1.552). This suggests that farming experience is an important determinant of micro-credit acquisition. The years of farming experience of the household head is believed to influence both access to loan and the size of loan. This is because older farmers with years of farming experience are expected to be knowledgeable about farming and the various sources of credit. They are also expected to have better credit management skills and credibility with lenders (Anang *et.al.* 2015). Farming involves a lot of risks and uncertainties; therefore to be competent enough to handle all the vagaries of agriculture, farmers must have stayed in farming business for quite some time (Ogundele and Okoruwa, 2006).

Annual income (X_7) had a negative coefficient (-0.321) and was not significant at 5%. This implies that those with low income had better chances to access micro-credit from financial institutions. The negative coefficient was expected because most of the credit that was made available to fish farmers were targeted to the real poor (those with low income). In addition, most of the available credit schemes had eligibility criteria favouring people with relatively low income in rural areas. This result is inconsistent with those of Anyiro and Oriaku (2011), Aliero and Ibrahim (2011) who find level of income to be an important determinant of demand for credit.

CONCLUSION AND RECOMMENDATIONS

The credit acquired by the small-scale fish farmers were used to the fullest in such items, as purchase fishing tools, meet land clearing needs, boost working capital base, purchase equipment, Meet storage needs, hire labour, servicing and maintenance of capital equipment, consumption needs and children's school fee payment. The fish farmers still felt that the credit should transform them from small-scale to middle or large scale of production. The loan obtained by the fish farmer though small was properly utilised because their production and income was increased. It must be stress that the farmers find it extremely difficult to achieve optimum progress and high performance because of what they encountered in obtaining the credits.

The following recommendations are made;

- i. The credit to farmers need to be increased so that the fish farmers could make greater impact on fish production and economic growth of the Nation.
- ii. The procedures for securing loans should also be streamlined in order to make it simple for the farmers.
- iii. Loans extended to young farmers with high number of dependents should be monitored

by the lending institution to ensure that these loans are applied to activities for which they are advanced for.

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Assessment of youth involvement in small scale rice production in Obafemi Owode local government area of Ogun state

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Abstract: The study was conducted in Obafemi Owode Local Government Area of Ogun State, to assess youth involvement in small scale rice production. Systematic sampling technique was used to select one hundred and twenty youths from rice growers' association in the study area. Simple descriptive statistics (frequency count, percentage, rank and score) and inferential statistics (Pearson correlation and chi-square) were used to analyse the data. The mean age of youths involved in rice production in the study area was 22.1 years. Majority (74.2%) of the youth in rice cultivation in the study area were literate. The major constraints faced by youth in rice production in the study area were processing (97.5%), poor storage facilities (90.0%), birds' infestation (85.0), high cost of production (77.5%) and high poll tax (62.5%). There were significant relationships between respondents' age ($r=0.220$, $p=0.021$); income ($r=0.084$; $p = 0.046$); farm size ($r = 0.067$; $p = 0.050$) and the youth involvement in rice cultivation. Ridging ($\chi^2 = 32.096$; $p = 0.000$); weeding ($\chi^2 = 4.377$; $p=0.036$); fertilizer application ($\chi^2 = 17.072$; $p = 0.000$) as cultivation practices were significantly related with the youth involvement in rice cultivation. The study recommended that youth farmers should form cooperative groups, so as to pool fund together and construct storage facilities in the study area.

Keywords: Youth, Small scale production, Rice cultivation, Storage facilities, Rice growers' association.

INTRODUCTION

In Nigeria, rice has emerged as one of the fastest growing agricultural sub-sectors and has moved from a ceremonial to a staple food in many Nigerian homes within the last two decades, such that some families cannot do without rice in a day. Nwachukwu, Agwu and Ezeh (2008) reported that as a staple food in Nigeria, rice accounts for 40 percent of the diet of the country's population but production has been growing at a slow rate relative to consumption within the last years. It is also reported that average yield of upland and lowland rain-fed in Nigeria (including the study area) is 1.8 tons/ ha while that of the irrigation system is 3.0 tons/ha. This appears low compared with 3.0 tons/ha for upland and lowland system and above 5 ton/ha in input- intensive irrigated system in Asia. (Ismail, Singh, Dar and Mackill, 2013). Youth in agriculture has been described as a very important structure for land and agrarian reform which will go a long way towards promoting the interest of youth in the agricultural sector of the economy (Gwanya, 2008). Jibowo (1998) describes youth as the constituent of a potent agricultural development. Also, Odebode (2000) opines that in Nigeria, youth formed a very significant proportion for rural communities for which their existence and potentials are well known. They constitute a large component of a country's population and contributed a lot to the development of the nation and in particular their local communities. Okeowo, Agunbiade and Odeyemi (1999) describe Nigerian agricultural production as relying on the use of physical strength, which declines with age. This, according to him, has been observed as one of the major constraints to agricultural production in Nigeria. Involvement of youth in agriculture especially staple foods production as rice is therefore vital to facilitate the production of food and the improvement of nutrition. Youth

involvement in rice production will therefore not only boost the much needed narrowing gap of demand and supply of rice in the Nigerian markets, improve the socio-economic life of the rural people but will also encourage development of vocational agriculture among the rural youths. It is against this background that this study investigated the level of youth involvement in rice production in the study area. Specifically, this study:

- i. Described the socioeconomic characteristics of the respondents in the study area.
- ii. Identified the youth's involvement in rice cultivation.
- iii. Identified the constraints faced by the youth in rice production in the study area.

The study hypothesised that:

H₀₁: There is no significant relationship between selected socio-economic characteristics of the respondents and their involvement in small scale rice cultivation.

H₀₂: There is no significant relationship between cultivation practices and youth involvement in rice cultivation.

METHODOLOGY

The study was carried out in Obafemi/Owode Local Government Area of Ogun State, Nigeria. Its headquarters is Owode town. Agriculture is the major occupation in the area with rice and maize mostly cultivated, while few engage in livestock and fish farming. Systematic sampling technique was used to select respondents for the study. According to the national youth development policies (FGN, 2001) defines youth as people aged between 18-35 years, and constitute about 40 million in Nigeria. Rice growers' association register in the local government was accessed, 1200 farmers within the age range of 18-30 years were found in the association register. Every 10th of the youth was systematically chosen for the

research work to give 120 respondents. Data was collected through the use of interview schedule and analysed using both descriptive statistics (frequency counts and percentages) and inferential statistics (Pearson Product Moment Correlation (PPMC) and Chi-square).

RESULTS AND DISCUSSION

Socioeconomic characteristics

Above average (50.8%) of the respondents were within the age range of 18 - 21 years, while 20.0% and 27.5% were between the ages of 22 - 24 and 25 - 27 years, respectively. The mean age of youths involved in rice production in the study area was 22.1 years. Agboola, Adekunle and Ogunjinmi (2015) were of the opinion that this age could make them be in better position to have access to training and skill acquisition in indigenous practices in cultivation, processing and even marketing. The results also show that 81.7% of the youths involved in rice production were single and 7.5% were married. This implies that majority of the respondents were still under the control of their parents. It was also revealed that majority (93.3%) of the respondents were male, while only 6.7% were female. This is in line with Nwibo, Mbam, and Biam (2016) that most of the agripreneur in Ishielu local government area of Ebonyi state were male. This may be due to the tedious nature of the

operations involved in rice cultivation. The mean farm size was 2.6 hectares. The small-scale farming of the respondents may be attributed to their inadequate access to land for farming. It could also be attributed to the use of primitive implement like hoes and cutlasses in carrying out farming activities. The finding is in consonant with Adesoji (2002) who reported that majority (95.0%) of arable crop farmers in Osun State were small scale farmers. Only 25.8% of the respondents had no formal education, it means majority (74.2%) of the youth in rice cultivation in the study area were literate. This implies that the respondents would understand innovations easily and thereby adopt innovation easily and quickly. Ogunbamere (2014) reported that highly educated farmers can get information on modern agricultural production techniques from a wide range of source such as extension agents, electronic or print media and internet. It is also in line with American Farm Bureau Foundation for Agriculture (2019) that agriculturally literate persons understand the relationship between agriculture and environment. Most of the youths in the study area were members of one social organisation or the other. It implies that youth in rice cultivation in the study area will have access to information on improved technologies, reputable sources of inputs and credit.

Table 1: Distribution of Respondents According to Socio- Economic Characteristics

Socioeconomic characteristics	Frequency	Percentage	Mean
Age (years)			22.1
18-21	61	50.8	
22-24	24	18.3	
25-27	35	29.1	
28-30	02	1.6	
Sex			
Male	112	93.3	
Female	8	6.7	
Religion			
Christianity	58	48.3	
Islam	60	50.0	
Traditional	2	1.7	
Marital status			
Single	98	81.7	
Married	9	7.5	
Divorce	7	5.8	
Separated	6	5.0	
Educational status			
Primary	14	11.1	
Secondary	62	51.7	
Tertiary	11	9.2	
Adult education	2	1.7	
No formal education	31	25.8	
Size of farm (ha)			2.6
≤1.00	22	18.3	
2.00	61	50.8	
3.00	9	7.5	

Socioeconomic characteristics	Frequency	Percentage	Mean
4.00	18	15	
5.00	1	0.8	
6.00	4	3.4	
8.00	5	4.2	
Cosmopolitaness			
Daily	20	16.7	
Weekly	27	22	
Monthly	14	11.7	
Occasionally	59	49.11	
Member of association			
Yes	85	70.8	
No	35	36.3	
Income per annum			270,842
<100,000	22	18.3	
100,000-500,000	96	80	
501,000-1,000,000	2	1.7	

Source: Field Survey, 2019

Youths' involvement in rice cultivation practices

Table 2 shows that 99.2% of the respondents claimed that they are involved in land clearing which was one of the major cultivation practices in rice production. It further reveals that 97.5%, 95.7%, 91.7%, 86.7% and 80.8% of the respondents claimed to participate in harvesting, control of pest/birds, fertilizer application, ridging and weeding, respectively as cultivation practices. To support the importance of fertilizer application as a cultivation Practice, Jing, Zhang, Rengel and

Shen (2012) stated that high nutrient concentration in the crop root Zone can increase root proliferation and enhance crop yield. According to Akobundu (1987) farmers spend more money on controlling weeds than they do on any other pest. However, only 5.8% of the youths claimed to be involved in irrigation as a practice. This may be as a result of the fact that irrigation structures are costly and complex to operate. It could also be due to the planting of lowland rice cultivation which does not necessarily require irrigation.

Table 2: Distribution of respondents by involvement in rice cultivation practices

Cultivation practices	*Frequency	%
Land clearing	119	99.2
Burning	83	69.2
Ridging	104	86.7
Mounding	69	57.5
Transplanting	59	57.5
Parboiling	82	68.8
Nursery	49	40.8
Mulching	45	37.5
Viability test	68	57.5
Weeding	97	80.8
Fertilizer application	110	91.7
Irrigation	7	5.8
Control of pests/ birds	115	95.8
Tillering	37	30.8
Harvesting	117	97.5
Drying	110	91.7
Toughening	63	52.5

*Multiple responses

Source: Field Survey, 2019

Constraints faced by youth in rice cultivation

Table 3 shows that processing (97.5%), poor storage facilities (90.0%), birds' infestation (85.0%), high cost of production (77.5%) and high poll tax after harvesting (62.5%) were the constraints being faced by the respondents in the study area. The poor storage facilities would have

been reducing the quality of the produce and thereby reduce the income of the farmers. This is in line with Ewuim, Nzegwu and Anaso (1998) that arable crop farmers who could not afford to get their products to the market due to poor transportation and storage facilities were forced to sell them at very low prices to middle men, who

eventually made more money than arable farmers. Also, birds' infestation as a constraint is in line with Global Rice Science Partnership (GRISP)

(2018) who identified birds as the second most important biotic constraint in African rice production.

Table 3: Distribution of respondents by constraints faced in rice cultivation

Constraints	*Yes	*No
People don't eat local rice	66 (55.0)	53 (44.2)
Birds infestation	103 (85.0)	16 (13.3)
Poor marketing of rice	46 (38.3)	74 (61.7)
Problem of processing	117 (97.5)	3 (2.5)
Inadequate machine for processing	114 (95.0)	6 (5.0)
Poor storage facilities	108 (90.0)	12 (10.0)
High Cost of production	104 (77.5)	16 (13.3)
Cultivation practices involved are many	93 (77.5)	27 (22.5)
Inadequate information on rice production	28 (23.3)	92 (76.7)
High poll-tax after harvesting	75 (62.5)	94 (36.7)

Figure in parentheses are percentages;

*Multiple responses

Source: Field Survey (2019)

The findings in Table 4 revealed that there were significant relationship between age ($p=0.0021$), income ($p=0.084$), farm size ($p=0.050$) and youth involvement in rice cultivation. It was further shown in Table 5 that there were no significant relationship between marital status ($p=0.084$), religion ($p=0.242$) and youth

involvement in rice cultivation. This is contrary to the opinion of Ani (2004) who reported that marriage was a determinant of a man's acceptability in his community and that until then the man had the right to be fed by his mother. Due to the significance of the variables, the null hypothesis is rejected.

Table 4: Summary of Pearson correlation analysis showing relationship between socio economic characteristics and youth involvement in rice production

Socioeconomic characteristics	r-value	p-value	Remark
Age	0.220	0.021	S
Income	0.084	0.046	S
Farm size	0.067	0.050	S

Source; Field Survey (2019)

Table 5: Chi-square analysis showing relationship between some selected socioeconomic characteristics and youth contribution to rice cultivation

Variable	χ^2 -value	DF	p-value	Remark
Sex	41.58	1	0.005	S
Marital status	2.987	2	0.084	NS
Religion	2.84	2	0.242	NS
Cosmopolitaness	43.51	2	0.48	S

Source; Field Survey (2019)

The results in Table 6 show that there were significant relationship between ridging ($p=0.000$), weeding ($p=0.036$), fertilizer application ($p=0.000$), viability test ($p=0.024$) and their involvement in rice cultivation. This implies that ridging, fertilizer application, viability test and weeding are important cultivation practices in rice production. Due to the significance of ridging, weeding,

fertilizer application and viability test, the null hypothesis was rejected. This is in line with Onieh et al (no date) that deficiency of nutrients needs to be corrected because it could limit plant growth and depress yield and also weeding should be done twice to minimize the effect of weeds on panicle initiation.

Table 6: Chi-square analysis showing relationship between cultivation practices and youth involvement in rice production

Cultivation practices	χ^2 -value	DF	p-value	Decision
Land clearing	2.773	1	0.096	NS
Burning	0.605	1	0.437	NS
Ridging	32.096	1	0.000	S

Cultivation practices	χ^2 -value	DF	p-value	Decision
Mounding	5.592	1	0.018	S
Transplanting	24.930	1	0.000	S
Parboiling	24.657	1	0.005	S
Nursery	2.947	1	0.086	S
Mulching	9.139	1	0.003	NS
Viability test	5.130	1	0.024	S
Weeding	4.377	1	0.036	S
Fertilizer	17.072	1	0.000	S

Source: Field Survey, 2019

CONCLUSION AND RECOMMENDATIONS

The findings established that land clearing, ridging, control of pest/birds, harvesting, drying, storage facilities and weeding were the rice cultivation practices in which youths were mainly involved while a few of them were involved in irrigation practices in the study area. Also, storage facilities, birds' attack, poor marketing and high cost of production were the constraints confronting rice cultivation in the study area. It was recommended that, government should put up a policy that will encourage youths to embrace rice cultivation as they progress in age. Youth farmers should form cooperative groups, so as to pool fund together and construct storage facilities in the study area.

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Palm oil marketing and financing in Oyigbo local government area of Rivers state

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Abstract: The study examined financing and marketing of palm oil in Oyigbo local government area of Rivers State, Nigeria. The objectives were to: describe the socio economic characteristics of the palm oil marketers; determine marketing efficiency of palm oil; examine the sources of finance for oil palm farmers; determine marketing channels of oil palm; examine the challenges of oil palm financing and marketing and determinants of oil palm funding by various funding sources. Data were collected through the use of a questionnaire. A total of fifty (50) respondents were purposively selected from two communities out of seventeen (17) communities, the selection of the two communities was based on the presence of oil palm processors. Data were analysed with the use of frequency, percentage, mean scores, marketing efficiency and ordinary least square (OLS) multiple regression. Findings showed that majority (63.0%) were male, (46.0%) were between 31 – 40 years, were married (66.0%), had secondary education (56.0%), were not cooperative members (80.0%), have household size of 5-8 persons (50.0%), have been in palm oil marketing between 6 - 10 years (40.0%) and had farm size between 1 – 10 (100.0%). Marketing efficiency of palm oil was 2.72. Majority (26%) of the marketers sourced finance from friends/relatives. Majority (70%) of palm oil marketing channel was Producer → Wholesaler → Retailer → Consumer. The major challenges of palm oil financing and marketing were: incompatibility of modern technology to local conditions (\bar{x} = 3.16), lack of storage facilities (\bar{x} = 3.14), lack of processing facilities (\bar{x} = 3.12), lack of access to credit and loans (\bar{x} = 2.90), low returns (\bar{x} = 2.72) and exploitative taxes and charges (\bar{x} = 2.64). The major (64%) determinant of palm oil marketing and funding was size of land. The result of the linear regression analysis showed that sex, marital status, farm size and cooperative membership were socio-economic characteristics that affect marketing efficiency at $P \leq 0.05$. The study recommends that palm oil marketers should have access to credit facilities from lending institutions in order to expand and improve their scale of operation.

Keywords: Palm Oil, marketing, financing, Oyigbo

INTRODUCTION

The oil palm (*Elaeis guineensis*) is one of the important economic crops in the tropics (Anyanwu; Anyanwu and Anyanwu, 1982). It belongs to the family *palmae* (having 225 genera with over 2600 species), and the subfamily *cocoideae* of which it is the most important member (Opeke, 1987). Generally, the oil palm tree is considered a "Complete plant" because all the products and by-products derived from the tree possess commercial importance. Hence, "No part of the tree is wasted". The principal product of oil palm is the palm fruit, which is processed to obtain three commercial products. These include palm oil, palm kernel oil and palm kernel cake.

The development of the economic oil palm had continued to attract the attention of various administrations in Nigeria since the colonial period to date. This was not unconnected with its economic importance as a very important source of edible and technical oils of a huge National revenue earning potentials. Palm oil and palm kernel oil, the major products of oil palm, were once very vital to Nigeria's export trade as Nigeria was a leading producer of oil palm produce in the world. In economics, production is never regarded as complete until the product gets to the final consumer, thus the importance of marketing. Olagunju (2008) reported that because of the increase in demand of palm oil, resulting from an increase in population and income growth relative

to the low productivity of the oil palm sector, Nigeria has become a net importer of palm oil.

There are indeed several factors that impede the efficient marketing of palm oil and they will need to be addressed because the potentials of the sector are too enormous to be neglected. Also, oil palm production in the state may have been largely affected by lack of financing, poor marketing, under investment in new technology, slow adoption of existing improved technology, limited land for oil palm cultivation and unavailability of skilled and unskilled labour. Again, there exist in the state, low production/output as well as low yielding varieties of palm seedlings planted at high maintenance cost (FMARD 2006).

Also, according to Carrere (2010), low provisions of market information standard and quality control constitute constraint to palm oil marketing. There are indeed several factors that impede the efficient marketing of palm oil and they will need to be addressed because the potentials of the sector are too enormous to be neglected.

This study is therefore designed to highlight the challenges of financing and marketing of palm oil in Oyigbo Local Government Area of Rivers State. The study answered the following research questions; what are the socio-economic characteristics of the palm oil marketers in the study area? What are the factors that influence marketing efficiency? What are the sources of finance available to oil palm farmers in the study area? What are the challenges affecting palm oil

financing and marketing in the area? What are problems being encountered by the palm oil marketers in the study area?

The broad objective of the study is to examine the financing and marketing of palm oil in Oyigbo Local Government Area of Rivers State.

The specific objectives of the study are to:

1. describe the socio economic characteristics of the palm oil marketers in Oyigbo Local Government area.
2. determine marketing efficiency of palm oil in the study area;
3. examine the sources of finance for oil palm farmers in the study area;
4. determine marketing channels of oil palm;
5. examine the challenges of oil palm financing and marketing in the area; and
6. determinants of oil palm funding by various funding sources.

The hypothesis was stated as follows: There is no significant difference between socio-economic characteristics and marketing efficiency of oil palm.

METHODOLOGY

This study was conducted in Oyigbo Local Government Area, one of the Upland areas of Rivers State in Nigeria where agriculture is predominant and constitutes the mainstay of the economy of the LGA, providing employment for the inhabitants. Oyigbo LGA is made up of a total of seventeen (17) villages which are divided into two parts namely Asa and Ndoki which share boundaries with Abia and Cross River States respectively (Iyagba and Anyawu, 2012).

The population of the study constitutes all smallholder oil palm processors and palm oil marketers.

A purposive sampling was used to select the respondent for this study. Out of the seventeen (17) communities in the local government, only two (2) were purposively selected. The selection was based on the presence of oil palm processor in the local government. The communities selected are Egberu and Kom kom respectively. Twenty five (25) oil palm marketers sampled randomly from each community of the local government above, giving a total sample size of fifty (50) respondents out of 75 that formed the sampling frame.

Data for the analysis was collected from primary source. The primary data was collected through the use of structured questionnaires administered to the 50 selected respondents.

Data collected from the respondents was analyzed using descriptive statistics such as mean score, table, percentage and frequency, while the ordinary least squares (OLS) regression technique will be used to test the stated hypotheses at 0.05 level of significance.

Objectives 1, 3 and 4 was analysed using frequency, tables and percentages. Objective 2 was analysed using marketing efficiency index. Objective 5 was analysed using a four point Likert type scales with options; Strongly Agreed (4), Agreed (3), Disagreed (2), Strongly Disagreed (1). The values assigned was added to get ten (10) which will be divided by 5 to get 2.5. This will serve as cut-off point.

The multiple regression model was implicitly specified as follows:

$$Y=f(X_1, X_2, X_3, X_4, X_5, X_6, \dots, X_n)$$

Where;

Y= Market Efficiency

X₁ = Sex (female = 0; male = 1)

X₂ = Age (years)

X₃ = Marital status (married = 1, Otherwise = 0)

X₄ = Household size (persons)

X₅ = Educational level (years in school)

b = Regression coefficient

u = error term

The explicit representation of the model were in three functional forms: the linear, double-logarithm function and semi-log form.

RESULTS AND DISCUSSION

Socioeconomic characteristics

The socio-economic characteristics of respondents are presented in Table 1. Table 1 shows that majority (62%) of the respondents were males, while 38% of them were females. This agrees with the study of Enwelu *et al* (2013) that palm oil production activities are mostly dominated by men. The male dominance could be attributed to drudgery nature and physical energy demand, and large financial investment needed for plantation establishment which discouraged women. The table shows that 66% of the respondents were married and therefore would have greater family responsibility, while 20% of the respondents were single and 14% were Divorced/Separated. This finding agrees with Ibitoye (2011) which confirmed that Nigerian farmers were mostly married.

The table also shows that majority (46%) of the marketers are within the age of 31 to 40 years. Those within the age of 21 to 30 years are 20%. About 22% of the marketers are within the age of 41 to 50 years, 10% fall within 51-60 years of age. Only 2% were above 70 years of age. The average age of the marketers was 45 years. This implies that palm oil marketing need able bodied men and women to carry out tasks such as loading, offloading, boiling of the palm oil in the drums which are some of the activities carried out in palm oil marketing. The age distribution among farmers in this study tends to agree with Ekong (2003) and Solomon (1994) which confirmed that Nigerian farmers are within the age bracket of 40-60 years. In relation to level of formal education attainment,

the table shows that a fair percentage (56 %) of the respondents had secondary education. About 24% of the respondents had primary education while 10% had adult literacy. Only 10% had no formal education. These results imply that majority of the marketers had one form of education or the other. (47%) of the respondents had HND/BA/Bed/B.Sc., 24% had ND/NCE, 23% had SSCE/WAEC, while only 6% of them had no formal education. Educated marketers may have better access to market information compared to non-educated marketers thereby increase marketing efficiency. This result contradicts that of Ukwuteno (2011) which confirmed that only 50 percent of the oil palm producers in the study area have up to primary six or seven as the highest level of education attained.

In terms of years of experience, majority (40%) of the respondents had between 6- 10 years of marketing experience. This was followed by 30% of the respondents which have had 11 - 15 years of experience. Then 16% of the respondents had 1 - 5 years of experience while 10% had 16 – 20 years of experience. Only 4% had marketing experience between 21 to 25 years. This shows that palm oil business had been an age long business and also those that have between 1 to 10 years of

business experience implies that more people are recently entering the business because of its profitability. The table also shows that a good percentage (50%) of the respondents had a household size of 5 – 8 persons, 30% of them had a household size between 1 - 4 persons, 16% of them had a household size of 9 - 12 while only 4% had over 13 persons in their household. This implies that the larger the family size, the more of labour component usage on the farm and the more mouths to feed but less farm income to be realized by the farmer. Tijjani (2006) noted that the major reason why farmers keep large family members is for the provision of farm labour during peak production periods. The table further shows that that most respondents (80.0%) do not belong to any cooperative(s) while only 20.0% do. Non-membership in farmers' cooperatives probably may have affected palm oil production negatively since palm oil marketers that do not belong to any cooperative(s) are likely to have less knowledge on palm oil production while those who have membership are likely to adopt innovation faster as they will have opportunity to mix with other adopters which may enhance exchange of ideas, attitudes, skills and knowledge among others

Table 1: Socioeconomic characteristics of respondents (n =50)

Variables	Frequency	Percentage (%)	Mean (\bar{x})
Age (years)			
21 – 30	10	20	
31 – 40	23	46	
41 – 50	11	22	50.5 years
51 – 60	5	10	
61 – 70	-	-	
71 – 80	1	2	
Sex			
Male	31	62	
Female	19	38	
Marital status			
Married	33	66	
Single	10	20	
Divorced/Separated	-	-	
Widow/Widower	12	14	
Educational Level			
No formal Education	5	10	
Primary Education	-	24	
Adult literacy	4	10	
Secondary Education	4	56	
Tertiary Education	8	-	
Farm Size			
1 - 10	50	100	
11 – 20	0	0.0	15.5 hectares
21 – 30	0	0.0	
Household size			
1 – 4	15	30	
5 – 8	25	50	10.25 persons
9 – 12	8	16	

Variables	Frequency	Percentage (%)	Mean (\bar{x})
13 – 16	2	4	
Cooperative membership			
Yes	10	20	
No	40	80	
Years of Experience			
1 – 5	8	16	
6 – 10	20	40	
11 – 15	15	30	13 years
16 – 20	5	5	
21 and above	2	4	
Total	50	100	

Source: Field survey, 2020

Marketing efficiency of palm oil

TC = Variable Cost + Fixed Cost + Other Cost = N350,440.00

TR = N 953,760.00

Marketing Efficiency (ME)

$$ME = \frac{\text{Total Revenue}}{\text{Total Cost}}$$

$$\text{Therefore ME} = \frac{953,760}{350,440}$$

ME = 2.72

From the result of cost and return analysis, it was shown that total revenue was N953,760.00 and total cost was N350,440.00. Therefore, the marketing efficiency of 2.72 shows that the marketers were efficient in the business having spent less of their sales revenue on cost. This

agrees with (Oladejo, 2014) who reported M-E of 1.17 for goat in Oyo State as profitable. (Mafimisebi *et al*, 2013) also reported a similar result as being profitable.

Sources of finance for palm oil marketers

From the result on table 3, majority of the palm oil marketers indicated that personal saving (40%) was the major source of their credit facilities. This was closely followed by friends and relatives (26%). Both cooperative societies (Esusu) and friends and relatives accounted for 66%. Only 10 respondents (20%) got credit from cooperative societies (Esusu) and 5 respondents (10%) indicated that they got credit from commercial banks.

Table 3: Percentage Distribution of sources of micro credit acquisition in the study area

Sources of micro credit	Frequency	Percentage (%)
Commercial banks	5	10
Cooperative societies (Esusu)	10	20
Money lenders	2	4
Friends/Relatives	13	26
Personal saving	20	40
Total	50	100

Source: Field survey, 2020

Palm oil marketing channels

Table 4: Percentage Distribution of palm oil marketing channels in the study area

Marketing Channel	Frequency	Percentage
Producer → Middleman → Wholesaler → Retailer → Consumer	8	16
Producer → Wholesaler → Retailer → Consumer	35	70
Producer → Retailer → Consumer	7	14
Producer → Consumer	0	0
Total	50	100

Source: Field survey, 2020

Figure 1 as shown below represents the marketing channel of palm oil from the producer to final consumer within the study area. The wholesalers often buy from the producers found at oil mills or

those that come to the markets. In turn, the wholesalers sell to wholesalers and retailers. The retailers then sell to the final consumers.

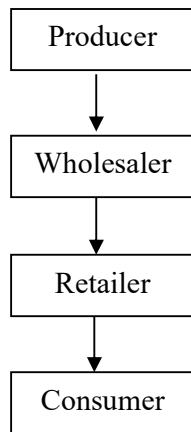


Figure 1 Flow chart showing oil palm marketing channel in Oyigbo LGA
Source: Field survey, 2020

Challenges of palm oil financing and marketing

Result on table 5 showed that the challenges affecting palm oil financing and marketing were incompatibility of modern technology to local conditions with mean score as 3.16, lack of storage facilities with mean of 3.14, lack of processing facilities with mean of 3.12, lack of access to credit and loans with mean of 2.90, low returns with mean response of 2.72, and exploitative taxes and charges with mean score of 2.64. Each of them

were above 2.5. This is an indication that each problem had positive effect on the respondents since most of the problems had a mean score higher than the cut off mark of 2.5. On the other hand, lack of improved materials seed/seedlings (M=2.06), lack of market (M=2.32), infestation of pest and diseases (M=1.94) and lack of infrastructure (roads, communication etc) (M=2.48), were not seen as challenges affecting oil palm financing and marketing in the study area.

Table 5: Response on challenges of oil palm financing and marketing in the study area

Challenges	SA (4)	A (3)	D (2)	SD (1)	Total Score	Mean Score	Remark
1 Lack of access to credit and loans	20	10	15	5	145	2.90	Agreed
2 Lack of improved planting materials seed/seedlings	10	6	11	23	103	2.06	Disagreed
3 Lack of storage facilities	17	23	10	0	157	3.14	Agreed
4 Lack of processing facilities	15	28	5	2	156	3.12	Agreed
5 Incompatibility of modern technology to local conditions	20	18	12	0	158	3.16	Agreed
6 Lack of market	10	8	20	12	116	2.32	Disagreed
7 Low returns	8	25	12	5	136	2.72	Agreed
8 Infestation of pest and diseases	7	6	14	23	97	1.94	Disagreed
9 Lack of infrastructure (roads, communication etc.)	10	12	20	8	124	2.48	Disagreed
10 Exploitative taxes and charges	8	23	12	7	132	2.64	Agreed

Source: Field survey 2020

Multiple Responses ≥ 2.5- Agreed; ≤ 2.5-Disagreed; SA= Strongly Agreed; A= Agreed; D= Disagreed; SD = Strongly Disagreed

Determinants of palm oil marketing funding

Table 6 shows that the respondents' size of land (64%), membership of cooperative (60%) and financial records (48%) as the major determinants of oil palm funding. This implies that the higher the farm size, the greater chances of acquiring funding for oil palm marketing. A second determinant of funding was membership of cooperative, this

implies that chances of obtaining funding from formal sources was to be a cooperative member since most formal sources don't fund individuals but only cooperatives, as such there is need for the marketers to be members of cooperatives so as to obtain funding and thereby increase their marketing efficiency.

Table 6: Percentage Distribution of determinants of oil palm funding

Determinants	Frequency	Percentage (%)
Size of land	32	64
Membership of cooperative	30	60
Provision of reputable guarantor	22	44
Financial records	24	48
Repayment capacity	22	44
Total	50	100

Testing Hypothesis

The research hypothesis was statistically tested for significance using the t-test (table 4.3.1). The test of significance of socio-economic characteristics and market efficiency was statistically significant at 5% level. Since the p-value of most of the variables is less than the probability value of 0.05, the alternative

hypotheses was accepted. This implies that the null hypothesis (H_0) which states that there is no significant difference between socio-economic characteristics and marketing efficiency is rejected; while accepting the alternative that states a significant difference between socio-economic characteristics and market efficiency.

Table 7: T-test Results of socio-economic characteristics and market efficiency

Variables	Mean	T	p-value
Market_Efficiency - Sex	1.15420	11.333	.000
Market_Efficiency - Age bracket	.23420	1.383	.173
Market_Efficiency - Years of Experience	.07420	.463	.646
Market_Efficiency - Cooperative membership	-.73420	7.227	.000
Market_Efficiency - Marital Status	.45420	2.974	.005
Market_Efficiency - Household size	.59420	4.206	.000
Market_Efficiency - Educational level	-.58580	-3.139	.003

Regression result of the socio-economic characteristics on marketing efficiency

Table 8 shows the result of multiple regression analysis determining the significance of socio-economic characteristics perceived to affect market efficiency in the study. The perceived factors (independent variables) are selected personal characteristics, sex, age, marital status, educational level, farming experience, farm size, cooperative membership and household size. The linear functional form was chosen as the lead equation based on the coefficient of determination (R^2) and the significant level of the F -ratio. The linear functional form had R^2 value of 0.541, which indicates that the independent variables can explain 54.1% of the variations in the dependent variable.

It was observed further that farming experience, sex, age, marital status and cooperative membership were significant at p-values ≤ 0.05 and ≤ 0.01 respectively. Thus, farming experience, sex, age, marital status and cooperative membership had effects on marketing efficiency of oil palm in the study area. The remaining four socio-economic characteristics namely, household size, farm size, educational level and age on the other hand were not significant since the significant values exceeded the conventional p-value ≥ 0.05 and ≤ 0.01 .

Sex was positively significant at 1%. This implies that male marketers are more efficient than their female counterpart in the study area.

Cooperative membership had the expected negative sign and was significant at 1%. Therefore belonging to an association reduces efficiency of small scale palm oil marketers in the study area. This finding disagrees with Kadurumba *et al.* (2009) and Ojo (2005) who reported that membership of association positively influenced technical efficiency levels of small scale palm oil processors in Nigeria.

Farming experience had a positive sign and was significant at 5%. This implies that increase in farming experience would increase the efficiency of palm oil marketing.

Marital status was positively significant at 5%. Therefore, married marketers had high efficiency compared to the single marketers.

Age) was negatively significant at 5%. This implies that the older a marketer gets, the lower his efficiency. This agrees with *a priori* expectation and can be attributed to various factors. As postulated by Onyebinama (2004), the age of a business manager is likely to influence his attitudes, motivation, behavioural patterns and capacity to adopt new innovation and his sensitivity to risk. Older marketers seem to be less receptive of innovative ideas and this affects their efficiency negatively. Also, old marketers are not always able to do a lot by themselves and may need to employ helps and this increases overhead cost which in turn, affects efficiency negatively.

The following regression equation was built from the lead equation.

$$Y=1.691+2.381(X_1)-0.820(X_2)+1.130(X_3)+0.583(X_4)-0.327(X_5)-0.504(X_6)+5.254(X_7)-4.256(X_8)$$

Table 8: Regression result of the socio-economic characteristics on marketing efficiency

Variables	Linear	Semi log	Double log
Constant	1.691 (.544)	4.919 (3.280)	.545 (4.610)
Sex	2.381*** (2.601)	7.495*** (2.438)	.430 (1.773)
Age	-.820** (-1.906)	-4.995 (-2.195)	-.093 (-.519)
Marital Status	1.130 ** 2.139	5.123** (1.913)	.129** (.609)
Educational Level	.583 (1.289)	4.099 (1.514)	.102 (.478)
Farming Experience	-.327** (-.678)	-2.373 (-.889)	-.116** (-.552)
Household Size	-.504 (.391)	-.591 (-.234)	.002 (.008)
Farm size	5.254 (4.127)	16.879 (4.032)	1.122** (3.396)
Cooperative membership	-4.256*** (-3.626)	-14.224 (-3.645)	-.704*** (-2.287)
R square (R ²)	0.541	0.531	0.348
F-Value	6.029	5.800	2.733

Source: Field survey, 2020, SPSS 23.0. Numbers in parenthesis are the *t*-ratio.
****significant at 5%, ***significant at 1%**

CONCLUSION AND RECOMMENDATIONS

The finding of the study revealed oil palm marketing in the study area was carried out mostly by married males who had one form of formal education or the other with large household size and still in their productive years. The major source of finance for the marketers was from personal saving. The result of the multiple regression analysis revealed that the socio-economic characteristics that have effect on marketing efficiency were sex, marital status, farm size and cooperative membership.

The farmers encountered problems of incompatibility of modern technology to local conditions, lack of storage facilities, lack of processing facilities, lack of access to credit and loans, low returns, high cost of land and exploitative taxes and charges. An attempt at solving these problems at the national and state levels will actually be a way forward in the drive for food security and poverty alleviation through palm oil marketing. Government must be seen to be actively involved in the procurement and distribution of essential resources such as storage facilities, processing facilities and also assist the farmers financially.

In line with the finding of this study, it is recommended that there should be provision of financial assistance to marketers through formation

of cooperative groups which would help ease their marketing inefficiency.

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Measuring effect of improved melon shelling technology adoption on well-being of rural women in Niger state, Nigeria using Propensity Score Matching (PSM) approach

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Abstract: Melon is an edible crop used for diverse delicious delicacies in West African countries. However, its processing remains tedious which might have adverse effects on the well-being of melon processors. Improved technology was introduced with the aim of reducing the burden of processing melon in Nigeria. This study therefore investigated the effects of improved melon shelling technology on the well-being of rural women in Niger State, Nigeria. Data were collected from survey of one hundred and ninety adopters and seventy-five non-adopters of improved melon shelling technology in Niger State, Nigeria. Propensity Score Matching (PSM) method was used to evaluate the effect of improved melon shelling technology on the well-being of rural women in the study area. Results show that literacy was very low for both adopters (4.2%) and the non-adopters (0%) but non-adopters have higher experience (19.2 years) in melon processing than the adopters (11.3 years). Personal Well-being Index-Adult (PWI-A) reveals that income and savings ($\bar{X} = 8.28$), household food security ($\bar{X} = 8.62$) and civic engagement in the community ($\bar{X} = 9.15$) of adopters were worthwhile. Also, 67.4 percent of the adopters had a good well-being ($\bar{X} \geq 51$) while 81.3 percent of non-adopters had a poor/not worthwhile well-being ($\bar{X} < 50$). The results of PSM showed a positive impact of improved melon shelling technology on the well-being of adopters ($t = 0.41$, $p < 0.05$). This study recommends that the non-adopters in Niger State should respond positively to technical changes by adopting and optimally utilising improved melon shelling technology rather than manual method in order to improve their well-being.

Keywords: rural women, melon shelling technology, well-being, Propensity Score Matching

INTRODUCTION

Processing of melon seeds into diverse products is extremely an important activity in its value chain because melon offers postharvest opportunities and value. The process of making snacks, sweetener, oil, and other melon products is well established in the rural areas of Nigeria. Today, there is considerable interest in processing to reduce postharvest losses in fruits and vegetables and as well to add value. In the past and up to the present, Nigeria has suffered tremendous loss of food products due to lack of proper and adaptable processing and packaging technologies (Udoh, 2009). A bulk of melon seeds are lost due to poor method of de-podding, fermentation, washing, drying, shelling, de-stoning, de-hulling, winnowing, grinding, oil extracting, roasting, and packaging. Over the years, melon had always been shelled manually with hands. Shelling is an important step in the processing of melon to its finished products. Shelling melon with hands often resulted in serious pains on the fingertips, ankle, waist and vertebra of the women. Breaking melon against stones often causes bruise in the hands of the processors. Traditionally, women working in tandem take several hours harvesting the melon, separating the seeds from the pod, drying, grinding, and allowing the seeds to steeping in salt to extract the oil, which is another important food product. However, it is difficult to make more than one gallon (4.55litres) of oil at a time because of the dearth of technology (Michael, 2010). The manual

shelling of the seeds therefore remains a limiting factor to the mass production and industrialization of melon in Nigeria (Shittu and Ndrika, 2012). Accelerating reductions in drudgery and low productivity require some drastic efforts in expanding the economic activities of the rural women who are involved in melon processing and marketing activities. As part of the Federal Government of Nigeria's effort to revamp agriculture, staple crop processing zones were established while improved small scale processing technologies, including melon processing technology, were promoted as a precondition for the overall growth in quantity and quality of agricultural commodities and supply in Nigeria (This day live, 2013). This growth is necessary to increase the nation's food production, Public Private Partnership (PPP), youth and women empowerment, among others (Akinwumi, 2012). This is to facilitate food security, diversify the economy and enhance foreign exchange earnings.

The food industry and agricultural sectors are strongly interrelated in most Sub-Saharan African (SSA) countries, and it can be a strong driving force towards the expansion in economic scale and activity of rural communities. In this regard, there has been increased development on improved melon processing technology (motorized melon shellers,) which is introduced to rural dwellers by the extension arm of National Centre for Agricultural Mechanization (NCAM) in collaboration with the Niger State Agricultural

Development Projects (NSADP) through exhibition and seminars to educate the melon farmers, processors and marketers on the advantages of its adoption (Mohammed *et al.*, 2014; The Tide, 2013).

Empirical studies have shown that gains from adoption of new agricultural technology influenced the poor directly, by raising productivity and income of farm households, and indirectly, by raising employment (Evenson and Gollin, 2003; Diagne *et al.*, 2009). The adoption of innovation is however the last step in a decision-making process to make full use of an innovation having considered that such will impact positively on the well-being of the adopter. To this end, the introduction of improved melon shelling technology is to reduce wastages, drudgery and contamination (sand, debris, dust) associated with traditional methods. The technology is designed to ease melon processing operations and increase productivity which will in turn affect economic returns and well-being of the rural women. The importance of technology in women empowerment cannot be over-emphasized, as it influences well-being of rural women and their households. In Nigeria, rural women are increasingly involved in melon processing for their livelihood sustainability. This technology could facilitate a better melon processing in terms of timeliness, cleanliness, reduced damage and large turnout. The broad objective of this study was to assess effect of melon shelling technology adoption on the well-being of rural women in Niger State.

METHODOLOGY

Data for this study were collected from survey of rural women in Niger State in the Northern part of Nigeria. The respondents for this study were selected based on the *a priori* information that they processed melon for commercial purpose. Snowball method was used to select seventy-five non-adopters of improved melon shelling technology while one hundred and ninety adopters were randomly selected from the list of 4,639 registered melon processors in Niger State, making two hundred and sixty-five melon processors selected for this study.

Data were collected on socio-economic characteristics and rural women well-being. Well-being of the rural women in melon processing was operationalized by using Core Welfare Indicator Questionnaire (NBS, 2006) and scale of Personal Well-being Index Adult (PWI-A) developed by International Well-being Group (IWbG, 2013) which focused on 7 domains. Scores were obtained and aggregated based on the number of items answered correctly with the maximum score of 100 and minimum score of 0. Mean score obtained from NBS and PWI-A was used to categorize the well-being as not worthwhile/poor for mean value

below 50, and worthwhile/good for scores above mean value of 50.

Assuming technology was randomly assigned to households – as it would be in an experiment for example – one could evaluate the causal effect of new technology adoption on households' well-being as the difference in average well-being between adopters of improved technology and non-adopters of the new technology. However, samples drawn from a non-experimental design have the problem of self-selection since the selection is not random. This makes it difficult to separate the effect of technology from other factors that can affect the decision of adoption. Scholars have reported that in the presence of selection bias, the comparison of means can provide misleading results (Croft *et al.*, 2007; Ali and Abdulai, 2010). The Propensity Score Matching (PSM) method was used to address the self-selection and evaluation bias. This method takes into account the counterfactual situation: "how much did the adopters benefit from improved melon shelling technology compared to the situation if they had not adopted. In this study, a Logit model was applied to estimate the propensity score. Logit model was used because of its mathematical convenience and simplicity as reported by Greene (2008). The propensity score represents the estimated propensity of being an adopter of improved melon shelling technology. The dependent variable takes the value of 1 if the rural woman is an adopter and 0 otherwise: the larger the score, the more likely the individual would be to adopt improved melon shelling technology. The choice of explanatory variables (i.e. conditioning variables) in predicting propensity score is crucial in propensity score matching analysis. The selection of covariates is in line with the assumption of un-confoundedness. Selection of variables that influence both treatment and outcomes, but are not affected by the treatment is recommended (Caliendo and Hujer, 2005). With a view to the conditional independence assumption, explanatory variables that are significant determinants of well-being and also correlated with technology adoption were selected. Socio-economic characteristics of the rural women such as, age, household size, educational status, marital status, household size, years of experience, man day, non-farm income, a dummy variable representing whether or not improved technology was adopted, and ownership of melon processing assets were selected. The variables used in this study were based on previous researches that have examined the impact of technology adoption on farmers' well-being in developing countries taking self-selection into account (Mendola, 2007; Wu *et al.*, 2010; Becerril and Abdulai, 2010). The basic idea behind PSM was to match each adopter with an identical non-adopter and then measure the

average difference in the outcome variable between the adopters and the non-adopters. It typically does this by comparing outcomes between beneficiaries and a control group (African Impact Evaluation Initiative (AIEI), 2010). Since the data for this study were obtained from survey, non-experimental impact evaluation design was preferred and analysed using Propensity Scores Matching (PSM).

The welfare effect of a technology (causal effect) for an individual processor is the difference between the outcomes:

$$T_i = Y_i(1) - Y_i(0) \dots\dots\dots(1)$$

T_i = treatment indicator (improved melon shelling technology)

$Y_i(1)$ = level of outcome variable for an individual processor who uses improved melon shelling technology

$Y_i(0)$ = potential level of outcome variable if this individual processor does not use improved melon shelling technology.

The difference between the actual and counterfactual situation known as ‘Average Treatment Effect (ATT) on the treated’ defined by Rosebaum and Rubin (1983) as:

$$T_{ATT} = E(Y|T = 1) - E[Y(1)|T = 1] - E[Y(0)|T = 1] \dots\dots\dots(2)$$

Technological effect is written as:

$$E(Y(1)|T = 1) - E[Y(0)|T = 0] = T_{ATT} + E[Y(0)|T = 1] - E[Y(0)|T = 0] \dots\dots\dots(3)$$

The difference between the left-hand side of equation (3) and T_{ATT} is the so-called self-selection bias. The true parameter T_{ATT} is only identified, if:

$$E[Y(0)|T = 1] - E[Y(0)|T = 0] = 0 \dots\dots\dots(4)$$

The PSM estimator for ATT is written in general as:

$$T_{PSM/ATT} = E_{P(X)|T=1} \{E[Y(1)|T = 1, P(X)] - E[Y(0)|T = 0, P(X)]\} \dots\dots\dots(5)$$

RESULTS AND DISCUSSION

Socioeconomic characteristics

The study reveals that 31.1% of adopters were between 31 – 40 years of age, while 41.3% of non-adopters were above 51 years of age. The mean age of adopters was 35.8 years, while that of non-

adopters was 43.3 years which indicate that non-adopters are older than the adopters. Proportion of adopters that were married was higher (84.7%) than that of non-adopters (50.7%). But, non-adopters had higher proportion for separated (22.6%) and widowed (20%) compared to 5.3% separated and 3.7% widowed among adopters. More than forty percent of adopters (41.6%) and non-adopters (49.3%) did not have formal education. Respondents that had primary education were higher (43.2%) for adopters than non-adopters (29.3%). Meanwhile, the proportion of respondents that had secondary education was almost the same for adopters (21.6%) and non-adopters (21.3%) but non-adopters did not attain tertiary education (0%), while few adopters attained tertiary education (4.2%). This implies that literacy was higher among adopters than the non-adopters. On the other hand 21.3% of non-adopters had more (11 people) in their households as against 11.6% adopters that had same number of household members. The mean of household size for adopters and non-adopters were 8 and 9 people respectively. This shows that the household size of non-adopters is relatively higher than that of adopters. Also, 53.3% of non-adopters had more than 21 years of experience in melon processing, while 11% adopters had similar years of experience. The mean year of experience for adopters was 11.3 years while that of non-adopters was 19.2 years. This indicates that non-adopters have higher experience in melon processing than the adopters. Also, the results on man-day of the respondents shows that 65.3% of non-adopters spent more than 9 hours in melon processing compared to 35.8% adopters that spent the same number of years in melon processing. The respondents were involved in various non-agricultural income activities with 26.3% adopters and 30.7% non-adopters engaged in petty trading, and 4.7% adopters and 6.7% non-adopters were into food stuff selling, while only few (2.6%) adopters were employed into civil service to generate additional incomes.

Table 1: Distribution of respondents by their socio-economic characteristics (n = 265)

Socioeconomic characteristics	Adopters (n=190)	Non-Adopters (n=75)
Age (years)		
Less than 30	50(26.3)	11(14.7)
31 – 40	59(31.1)	14(18.7)
41 – 50	57(30.0)	19(25.3)
51 and above	24(12.6)	31(41.3)
Mean	35.8	43.4
Marital status		
Single	12(6.3)	5(6.7)
Married	161(84.7)	38(50.7)
Separated	10(5.3)	17(22.6)
Widowed	07(3.7)	15(20.0)
Years of Education		
No formal education	79(41.6)	37(49.3)

Socioeconomic characteristics	Adopters (n=190)	Non-Adopters (n=75)
Primary education	82(43.2)	22(29.3)
Secondary education	41(21.6)	16(21.3)
Tertiary education	08(4.2)	0(0.0)
Household size		
Less than 5	16(8.4)	7(9.3)
6 – 10	152(80.0)	52(69.3)
11 and above	22(11.6)	16(21.3)
Mean	8	9
Years of experience		
Less than 10	101(53.2)	12(16.0)
11 – 20	68(35.8)	23(30.7)
21 and above	21(11.0)	40(53.3)
Mean	11.3	19.2
Manday (hours)		
6 – 8	122(64.2)	26(34.7)
9 and above	68(35.8)	49(65.3)
Mean	8.1	9.0
Non-Farm income activities		
Petty trading	50(26.3)	23(30.7)
Civil service	05(2.6)	0(0.0)
Food stuff selling	09(4.7)	05(6.7)
None (Full-time melon processors)	126(66.3)	47(62.6)

Source: Field Survey, 2018.

Values in parenthesis are percentages

Well-being of rural women in the melon processing activities

From the results of PWI-A in Table 2a, the mean score of health shows that the general state of health of adopters ($\bar{X} = 5.59$) and non-adopters ($\bar{X} = 5.01$) in relation to melon processing activities was moderate. Since there is a common saying that “health is wealth” hence, good health is an important indicator of quality life and overall well-being (Dolan *et al.*, 2008). The result also shows that the income and savings for adopters were better ($\bar{X} = 8.28$) while that of non-adopters were poor ($\bar{X} = 2.86$). This indicates that return on investment for melon is economically viable for the adopters of improved melon shelling technology and thereby considered it worthwhile. Contributions of adopters to household food security was relatively high ($\bar{X} = 8.62$) than that of non-adopters ($\bar{X} = 8.62$), hence adopters felt satisfied with food and nutrition domain of well-being. The support given to children’s education by adopters was worthwhile ($\bar{X} = 8.23$) compared to low support from the non-adopters ($\bar{X} = 3.41$). This is an indication that income, household food security and children’s education of adopters of improved melon shelling technology are better than that of non-adopters. The result coincides with the findings of Sodiya and Oyediran, (2014) that melon production contributed to rural farmers’ household food security, served as income to farmers, gift to relatives, seeds for next cropping season and as local medicine in treating some ailments in Oyo State, Nigeria. These findings also support the assertion of Klasen, (2002) and United Nations, (2009b) that rural women access to technology and

better income could enhance their children’s nutrition, education and well-being. Globally, women have been recognized for their unique contributions to livelihood sustainability and well-being of their families through food production, processing and marketing of agricultural produce (IFPRI, 2012; World Bank, FAO and IFAD, 2009). The respondents also reported that their civic engagement in the community was worthwhile for adopters ($\bar{X} = 9.15$) and non-adopters ($\bar{X} = 5.35$) though that of adopters shows a relatively high satisfaction. However, the adopters ($\bar{X} = 4.70$) and non-adopters ($\bar{X} = 2.65$) considered their accommodation as not worthwhile and it was rated low. This may be due to lack of some basic facilities like furnished kitchen and toilet that are not up to standard if compared to modern houses in the urban centres in Nigeria. Consequently, the respondents described the housing condition as not worthwhile. This dissatisfaction may not be unconnected with the rural women cosmopolitaness that exposes them to modern houses in cities, and the limitation to jointly fund a house project that belongs to their husbands especially in a polygamous family set up. A poor and unsafe housing constitute a large burden to individuals (Fabrice and Culver, 2010). According to Maslow (1954) cited in Huitt, (2007) housing is one of the physiological needs of an individual and it is essential for well-being. But, the adopters ($\bar{X} = 8.64$) and non-adopters ($\bar{X} = 6.90$) indicated that they were satisfied with their relationship to other people in the melon processing and marketing activities and enjoyed recognition within the community. Social contact is fundamental to the

sense of well-being, as it has bearing both on life evaluations (Boarini *et al.*, 2012). Similarly, security domain showed that adopters ($\bar{X} = 8.84$) and non-adopters ($\bar{X} = 7.54$) felt satisfied with safety as there was no reported case of thefts, attacks, and work place hazards in the study area. Boarini *et al.* (2012) reported relationship between experience of victimization and well-being. Also, the adopters were satisfied with their leisure ($\bar{X} = 6.72$) and life ($\bar{X} = 6.38$) while non-adopter were dissatisfied with their leisure ($\bar{X} = 2.16$) and life ($\bar{X} = 4.27$). Thus, adopters of improved melon shelling felt satisfied with achievements in the melon processing and considered their well-being as worthwhile compared to the poor case of non-adopters. In line with findings from this study, Nwanesi (2006) reported that the level of well-being and the economic position of most rural women depend on several factors; these include whether they are landless or landowning, whether they have access to productive resources and technology or whether they are recognized in the community. It was further stated that the size of the rural women's production is equally important, if they have their own income and satisfied with it, if they have taken any micro-credit loans, or if their income is reserved for a "head of the family" or children, and if they sell their products to make

profit or give out some as charity. These are some of the dynamic features which shape the feelings of rural women on their economic position and well-being status in Nigeria.

The result of categorization of well-being in Table 2b indicates that 67.4 percent of the adopters had a good well-being ($\bar{X} \geq 51$). In contrast, most (81.3%) of non-adopters had a poor/not worthwhile well-being ($\bar{X} < 50$). The implication from the results of foregoing is that adoption of improved sheller technology for processing melon has a multiplier effect on the growth and development of melon processing in terms of output, income generation and savings as well as further investment. Technology adoption has the potential of improving the livelihood needs of rural women through increased income levels leading to women being food secured, having access to better housing, women's ability to pay their wards education, payment of medical bills and reduction in vulnerability of the women (Fadilah *et al.*, 2013). Doss *et al.* (2003) cited in Idrisa *et al.* (2010) also opined that adoption of improved technologies is an important means to increase the productivity of smallholder agriculture in Africa, thereby fostering economic growth and improved well-being for millions of the poor households.

Table 2a: Well-being of Rural Women in the Melon Processing

s/n	Well-being domains	Classification	Adopters (n = 190)	Non-adopters (n = 75)
			\bar{X}	\bar{X}
Objective well-being				
1.	Health	Psychological	5.59	5.01
2.	Food and Nutrition	Physical	8.62	5.42
3.	Income and savings	Economic	8.28	2.86
4.	Education	Physical	8.23	3.41
5.	Accommodation	Physical	4.70	2.65
Subjective well-being				
6.	Social cohesion and relations	Social	8.64	6.90
7.	Civic engagement	Psychological	9.15	5.35
8.	Physical safety	Social	8.84	7.54
9.	Leisure	Psychological	6.72	2.16
10.	Life satisfaction	Cognitive	6.38	4.27

Source: Field Survey, 2018.

Table 2b: Categorization of Well-being of Melon Processors

Well-being	Scores	Adopters (n = 190)		Non-adopters (n = 75)	
		Frequency	Percentage	Frequency	Percentage
Not worthwhile/Poor	< 50	62	32.60	61	81.30
Worthwhile/Good	≥ 51	128	67.40	14	18.70

Source: Field Survey, 2018

Estimate of Average treatment effect (ATT) of technology adoption on rural women well-being

The statistical significance of the ATT was tested using t-values calculated from 50 times bootstrapping standard errors as recommended by Becker and Ichino, (2002). The technological effect on rural women well-being is estimated through two different methods, that is, the Nearest Neighbour Matching (NNM) and the full matching methods. The common support condition is imposed and the balancing property is set and satisfied in all regressions at 1% significance level. The different matching algorithms produced different quantitative results, but the qualitative findings are similar. Overall, matching estimates show that improved technology adoption has a positive and robust effect on rural women well-being. The results of full matching presented in Table 3 show a positive impact of improved melon shelling technology on rural women's well-being, a significant value of $t = 0.41$, that is, experiencing a good well-being by 41.0%. Also, the nearest-neighbour causal effect of technology on rural women's well-being is highly significant and equal to about $t = 1.83$, which is the average difference between well-being of similar pairs of melon processors but belonging to different status in their melon processing operations (adopters and non-

adopters). For this study it is inferred that the difference between the economic returns and well-being of both matched groups are the outcome of their decision to adopt the improved melon shelling technology. This is based on the fact that the two groups are matched on the equality of their propensity scores. In addition, the good well-being is attributed to the higher productivity with attendant higher economic returns from improved melon shelling technology. The result is in agreement with similar findings on poverty analysis measuring the differential impact of agricultural technology adoption on poverty reduction among the rural households using PSM. Becerril and Abdulai (2010) reported that adoption of improved maize reduces the probability of falling below poverty line roughly between 19 to 31 percent in the two study areas of Oaxaca and Chiapas, Mexico. Similarly, Mendola (2007) finds that adoption of high yielding varieties (HYVs) of rice has a positive and robust effect on households' income and the way out of poverty in rural Bangladesh. The result is also in consonance with general findings of Hazell (2008), Wu *et al.* (2010), Challa and Tilahun, (2014) regarding the impact of agricultural technologies on household poverty reduction and well-being.

Table 3: Technological effect on rural women well-being matching estimates

Dependent variable	Effect	
Well-being	NNM	Full matching
	0.02 ^b (1.83)***	0.82 ^b (0.41)***
Balancing property satisfied	Yes	Yes
Common support imposed	Yes	Yes
Observations		
Treated	190	
Controls	75	

Source: Calculated from field data, 2018. t-statistics in parenthesis.

^bBootstrapped t-statistics, 50 replications. *** Significant at 1% level

CONCLUSION

The use of cross-sectional data at establishing the effect of technology adoption on well-being is a great task because it is not so easy to separate socio-economic factors from technology effects. The self-selection bias was addressed with PSM model and the findings show a positive impact of improved melon shelling technology adoption on rural women well-being. It is therefore recommended that non-adopters in Niger State should continue to respond positively to technical changes by adopting and optimally utilising improved melon shelling technology rather than a very tedious hand shelling method. The melon processors should as well form themselves into larger cooperative groups for easy access to modern technology, agricultural loans and other government largesse. In addition, agricultural

extension services should be proactive in the service delivery and ensure adequate training support is given to the rural women, this will facilitate further adoption of the technology in the study area.

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