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POTENTIALS OF BLACK SOLDIER FLY AS AN ALTERNATIVE TO HIGH PROTEIN COMPONENT IN FEED COMPOSITION IN NIGERIA

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ABSTRACT
Insects have been the natural food for livestock especially poultry. This option of using insect have been neglected or narrowly explored for commercial livestock production. Recently, the rising concern for the environment, increasing human population and scarcity of animal feed ingredient calls for increased campaign for the use of environmentally friendly approaches to sustainable food/feed production and consumption, this necessitates the use of promising insect species as feed for livestock. Thus, research and innovation in animal nutrition is driving the production of edible insects, as their production falls short of global demand. Among such insect species, the Black Soldier Fly (BSF) is highly considered as its nutritional, health, environmental and livelihood features and life cycle positions it for varied beneficial use. Research has shown that BSF is rich in crude protein, fatty acid and chitin. The larval stage of this insect is saprophagous and has the ability to degrade organic waste materials and convert them to useful materials in the form of nutrients for animals and plants. Research in this area is gaining global recognition, thus, this study seeks to review the potentials of BSF as an alternative to high protein component in feed composition in Nigeria. The review showed that BSF is a rich source of animal protein for livestock and fish feed. It also has a waste management potential, which adds to its sustainable use as it has the capacity to reduce greenhouse gas emission, global warming and climate change.

Key words: Black Soldier Fly, Feed composition, Feed Protein component

INTRODUCTION
The growth in world population mounts great pressure and demand for animal and plant protein sources for use as food by humans and animal feed component. No doubt, the growing world population, estimated at 9 billion people by 2050, Abd El-Hack *et al.,* (2020), necessitates increased production of crops (soybean) and livestock (fish), which are the chief source of protein in the global feed industry. Evidence have shown that the energy cost, quality and quantity of major poultry feed ingredients (maize and soybean) may be influenced by global warming and climate change, this exacerbates food security concerns. Furthermore, Shumo, Khamis, Tanga, Fiaboe, Subramanian, Ekesi, Van Huis, & Borgemeister, (2019) highlighted that two third of world population will reside in urban centres by 2050. They also indicated that 115% increase will be likely recorded in urban centres in sub-Saharan Africa. This will put great pressure on farmers to supply the food need in urban centres, especially animal protein. Small holder farmers contribute greatly to food supply. Most of these farmers depend solely on rain-fed agriculture for their produce. Global warming and climate change have reduced the available land for farming, thus, adversely influencing production. Furthermore, increasing population drives urbanization, increased consumption, waste generation and environmental pollution if the wastes so generated are not properly managed. Shelomi (2020) indicated that organic wastes such as food waste and animal manure are posing great environmental concern in the Pacific Islands.

Fishmeal, a major source of animal protein is also under threat. Studies have shown that despite the fact that the aquaculture industry is growing, fishmeal is on the decrease, due to decreased supply of industrial caught fish, additional fishing regulations and use of more cost-effective fishmeal substitutes (Van Huis, Van Itterbeeck, Klunder, Mertens, Halloran, Muir, and Vantomme, 2013). The demand for fishmeal continues to increase, thus raising the cost of production of livestock and fish. Van Huis *et al.,* (2013) pointed out that fish meal used in the aquaculture sector was 19% in 2005, this decreased to 13% in 2008 and they predicted a decrease to 5% by 2020.

Alternatives have been sought which can produce high quality protein at reduced cost, with lower negative environmental impact, and insects have been seen to be an option to reduce green house gas emission, lower environmental pollution, manage organic waste and provide better protein for use. In ancient times, insects have been used for food by some communities. Recent breakthrough in animal nutrition shows that insect meal can be used as food and feed (Abd El-Hack et al*.,* 2020). Notable among these is the Black Soldier Fly (*Hermetia illucens*) (Diptera: Stratiomyidae) is an insect with four stages in its life cycle namely; egg, larva, pupa and adult. The larval, pupa and adult of this insect are edible and is been shown to be consumed by rabbit, poultry, fish, swine and even people (Shelomi, 2020). The commercial farming of Black Soldier Fly is gaining popularity because of its characteristics. The Black Soldier Fly is not a pest, they feed on organic waste and piles in homes or farms and the larvae is rich in protein and fat which makes them suitable for use in livestock feed. Compared to fish meal and soybean, these insects require a small portion of land to be grown and the reproduction rate is by far higher than that of crops and fish. Research and experiments have shown that meals from the larvae of BSF have been used to successfully feed fish, poultry and pigs (Abd El-Hack *et al.,* 2020). Stamer, Wesselss, Neidigk, & Hoerstgen-Schwark, (2014) in their work on BSF larvae-meal as an example for new feed ingredients' class in aquaculture diets observed that BSF meal can substitute 50% of fish meal as a feed component in trout feeds.

The Black Soldier Fly, has a lot of potentials, evidence has shown that the larvae which is considered to be of great usefulness in livestock feed can be reared on a wide range of organic waste material. On feeding on the organic waste, it has the capacity to reduce volume of the waste by 50%, produce biomass with about 42% crude protein and 32% fat. Caruso, Devic, Subamia, Talamond, & Baras, (2013) indicated that the current campaign for the large scale production of BSF and its use as animal feed arose from scarcity of feed materials for animals. Times of emergencies present great challenges which often lead to innovation. The COVID -19 pandemic in Nigeria recorded scarcity of livestock feed in Nigeria and smallholder farmers found it difficult to stay in business and sustainably supply animal protein to the market. This study was carried out to review the potentials of BSF as an alternative to high protein component in livestock and fish feed industry in Nigeria.

Overview of the livestock and fishery industry in Nigeria

Globally, the livestock sector contributes 40% to the Gross Domestic Product of the agricultural sector (Van Huis *et al*., 2013). However, they indicated that the mini livestock sector offers a potential for economic diversification.

Overview of the livestock and fish feed industry; challenges

The livestock feed industry plays great role in the supply of animal protein. This industry is estimated to produceone billion tonnes of feed annually and valued at $400 billion in 2020 (https://ifif.org/global-feed/industry/). Over the years, the major components for animal and fish

feed are fish meal, fish oil, soybean, several other grains(Van Huis et al., 2013), palm kernel meal and so on. The authors indicated that the use of these materials as feed take up to 60 to 70 per cent of the cost of animal production. Shumo *et al*., (2019) indicated that the use of food-feed ingredient in feed production creates food-feed competition thus increasing food and feed cost. Van Huis, *et al*., (2013) showed that the prices of fish meal is on the increase, this poses a great threat to the sustainability of smallholder farmers as aquaculture and fish production needs to be increased to enhance the supply of fish meal.

Chia, Tanga, Van Loon and Dicke, (2019) in their work emphasized that "Global population growth, increasing demand for animal products and scarcity of conventional feed ingredients drive the search for alternative protein sources for animal feed". However, it has been shown that insects are sustainable, of high quality and provide low cost component of animal feed.

Potentials of BSF as an alternative to feed in the livestock industry

Insects are a class of animals with mainly three body regions (head, thorax and abdomen), exoskeleton, three pairs of jointed appendage, an antenna and a compound eye. This group of animal is found almost in all environments due to the role they play in the ecosystem. However, human perception of insect are varied because of their diversity, and action. In addition, insects play key role as natural resource, serve in human food and animal feed and also to improve livelihood. Van Huis *et al.*, (2013) reported that over 2 billion people globally use more than 1,900 species of insects as food. They explained that insects have the same market as fishmeal and can be used in feeding of fish, livestock and pets. FAO (2012) in Caruso, Devic, Subamia, Talamond & Baras (2013) reported that over 527 species of insects are consumed by humans in 78 countries. Insects are rich source of nutrients, require less productive resources (land, energy and water) for their production, and are less environmentally destructive (Shelomi, 2020). The features of insects make their cultivation to ease and they can be reared in urban, peri-urban and rural areas (Oonincx, and de Boer, 2012).

Black soldier fly (BSF) (*Hermetia Illucens*) is increasingly been considered as an alternative to the local protein component in livestock feed. The larvae of BSF is been increasingly considered as an alternative to the protein components (soybean and fishmeal) used in livestock feed (poultry and fish feed) due to it high protein and fat content. Studies have shown that insect meal from the larvae of BSF is been included in the European Union Feed Material Register (Abd El-Hack I., 2020). Shelomi (2020) reported that the use of BSF has been approved for use in the USA as feed for poultry and salmonid fish. The author also indicated that the European Union has approved its use in aquaculture. Stamer, *et al*., (2014) reported the suitability of BSF larvae meal for warm water fish species, while indicating that limited evidence exist on their suitability for cold water fish species.

Nutritional and Health potentials

Insects are a healthy and nutritious food and feed source, especially when compared with alternative sources from plant and other animal sources. They are a rich protein source with good fat (Van Huis *et al*., 2013). The authors also indicated that insects are rich sources of calcium, iron, phosphorus and zinc. However, the chemical composition of insect meals is influenced by their diets and stage of development (Oonincx, Van Broekhoven, Van Huis, Van Loon, 2015).
The Black Soldier Fly pre-pupa stage is been used both as feed component and complete feed for pigs, poultry and fish. Bullock, Chapin, Evans, Elder, Givens, *et al*., (2013) noted that the pupa

of BSF can be fed to chicken and are good source of protein. Research has shown that this stage of the BSF contains 47% crude protein and 35% ether extract on dry matter basis (Abd El-Hack *et al*., 2020). With regards to the crude protein content of BSF, the lowest recorded value is 36%, according to the authors; this value is higher than most crude protein content in plant sources like sunflower, linseed and cotton seed meals.

The fat content of BSF is an alternative to other sources such as Palm kernel, fish oil and soybean. According to Abd El-Hack *et al*., 2020, the BSF meal can comfortably replace these fat sources in animal feed without any detrimental effect on growth performance, health and digestibility. However, the essential fatty acid content of BSF is of great concern as research has shown that it is low in essential fatty acids. Essential fatty acids have been valued greatly for their role in improving the health condition and productivity of poultry (Abd El-Hack *et al.,* 2020), so this must be provided for when compounding poultry feed with BSF. The authors reported availability of oleic fatty acid, indicating that is availability limits the amount of linoleic and ά linoleic fatty acids present in the BSF larvae. Studies show that insect meals from BSF is rich in micro-nutrient, however, Abd El-Hack *et al.*, 2020, added that there may be some trace of toxic micro-nutrients in insect meals and adequate care should be paid in their production to limit these toxic micro-nutrient.

Chitin a polysaccharide found in lower organisms is present in insects, forming a great part of their exoskeleton. This nutrient is of great biological and economic value. According to Abd El-Hack *et al*., 2020, chitin and its derivatives have various use in the food, cosmetics, pharmaceutical, waste water treatment, textile industry and in agriculture. They also reported that chitin is been increasing used as a feed supplement, and has antibacterial, antifungal and antiviral potentials. It has also been reported that chitin performs the function of antioxidants.

Table 1: Nutritional value of BSF Pre-pupae stage

Nutrient	**Protein**	**Fat**	**Micro-nutrient**	**Vitamins**	**polysaccharide**
Crude protein	36 – 65%				
Amino acid	Methionine, Lysine, Valine, Arginine (2 – 3 mg/100g DM				
Fatty acid		Lauric acid (28.9 – 50.7%)			
Crude fat		(4.6 – 38.6%)			
Vitamins				Vitamin E	
Minerals			Iron, calcium, phosphorus , and zinc		
Chitin					Good

Adopted from Abd El-Hack *et al*., 2020

Above all, Stamer, Wesselss, Neidigk and Hoerstgen-Schwark (2014) in their research observed a decrease in body weight of trout fish fed with BSF larvae meal. Their research on BSF as an alternative protein source in aquaculture diet showed that trout fish fed with 50% BSF meal had 13.4% lower body weight while fish fed with 75% BSF meal recorded 15% lower final body weight when compared with the control group (fed with conventional feed). In addition, the research also showed that body weight gain, feed conversion ratio and protein efficiency were comparable, especially with the fish fed the BSF 50% replacement and the control. The researchers concluded that the overall performance and digestibility of aqua-feeds containing BSF should increase if the level of lipids is reduced by mechanical defattening of BSF raw material.

Environmental potentials

In developing countries, organic agricultural resources pose a serious concern, as they are often heaped on the road, causing road and drainage blockage, expensive waste management schemes and air and water pollution. Shelomi (2020) indicated that over 40% of the solid wastes in Pacific Small Island Developing States (PSIDS) are organic wastes, suggesting that many waste management problems faced in PSIDS can to some extent be alleviated by insect farming and BSF.

The commercial production of livestock (fish inclusive) and other plant protein sources for feed have been widely criticized for the emission of greenhouse gases which promote climate change. Commercial aquaculture which is the chief source of fish meal and the commercial production of soy bean has consequent environmental concerns. However, only few insect groups; termite and cockroaches have been shown to emit methane (Van Huis *et al*., 2013). The commercial production of insects is not only beneficial in terms of its use as food and feed, but also as an organic waste control. Research has shown that BSF larvae can grow on a wide range of substrate; tomato plant compost (Stamer *et al.*, 2014), poultry waste, kitchen waste, fish, industrial operations waste, that is brewers spent grain (Abd El-Hack, *et al*., 2020), corpse, and coconut shell (Shelomi, 2020).

Some non pest insect species have been shown to reduce the nitrogen and phosphorus content in organic waste by 75% and the organic mass by 50% (Abd El-Hack *et al*., 2020). The authors indicated that the larvae form of BSF has been shown to reduce waste moisture, waste volume, offensive odour and pollution potential and elimination of house fly for organic waste accumulated from livestock. Thus, help to reduce environmental pollution potential that would have been posed by this waste. Value added manure management is another property and role played by BSF. Evidence has shown that BSF serve to convert wasted agricultural resources which is posing great environmental challenges. Shelomi, (2020) reiterated that over 40% of the solid waste in Pacific Small Island Developing States (PSIDS) are organic wastes, pointing out the expensive nature of existing waste management schemes indicated that many waste management problems faced in PSIDS can be alleviated by insect farming and BSF.

When it comes to land and feed requirements, insects need only little land for their growth and production compared to other feed components from plant and animal sources. In addition they have a high feed and protein conversion ratio.

Livelihood potentials

Rearing of insect requires low investment and capital and can be practiced by the poorest in the society. The production of BSF can easily be done by smallholder farmers since the larvae grow

on a wide range of organic matter, thus, agricultural and kitchen waste material can easily be converted to income, animal feed, and healthy manure for environmental sustainability. This also holds an opportunity for farmers to diversify their livelihood options as they can use the waste form the farm to produce feed for their livestock. Thus, generate wealth from waste raw materials. The rearing of insects have the capacity to include small scale farmers as producers, suppliers and users of insects and insect meals, thus encouraging circular economy and inclusive business (Chia, Tanga, Van Loon, & Dicke, 2019)

In addition, the larvae can also be processed and sold to livestock farmers in the area to generate income. Van Huis *et al*., (2013) indicated that processed BSF larvae is valued at approximately US$200 per tone. In most communities where insects are consumed, feeding on insects is rather by choice rather than a necessity; however, insects have proven to sustain life during periods of seasonal food shortages (Van Huis *et al*., 2013). The authors also indicated that the collection and rearing of insects support efforts aimed at acquiring food, farm inputs and education. In addition, insects have been shown to have the capacity to improve local diets, strengthen access and land tenure rights to local resources and provide opportunities for improving women's livelihood (Van Huis *et al*., 2013).

Advantages of insect rearing

The insect rearing enterprise is gaining ground and has several advantages over the livestock sector. According to FAO, (2011); Van Huis *et al*., (2013), they advantages of this sector include:

- Minimal space requirement for production
- Less competition with human food sources
- High demand for insects and their products which outweighs supply
- Are highly productive
- Due to their short life cycle can produce cash within a short period of time
- Have high nutrient content
- Have high feed to protein conversion efficiency
- Are easy to manage and transport
- Require little or no training to rear.

Above all, Chia, Tanga, Van Loon and Dicke, (2019) indicated that the impact of the wide use of insects in animal and fish feed production and organic waste management could help in achieving sustainable development goals 1, 2, 5. 6, 8, 9, 12, 14 and 15.

Constraints on using BSF for feed

Black soldier fly production has been found to be greatly affected by temperature, and Abd El-Hack *et al*., (2020) indicated that the chemical composition of insect meal is affected by their diet and developmental life style.

In addition, the commercial and sustainable production of BSF requires large amount of insect biomass to meet demand. Increased demand therefore leads to high cost of insect meals as there is limited commercial production of BSF (Abd El-Hack, *et al*., 2020). Van Huis *et al*., (2013) noted that the cost of production (labour and housing) for large scale feed production facilities are much higher for insects than for the production of chicken feed. This may be so due to the fact that insects are living and require several activities and actions to keep them alive while producing feed.

Furthermore, Abd El-Hack, *et al*., (2020) pointed out that there are legislative constraints to the large-scale production of insects for food and feed especially in Europe. According to Shelomi (2020) legal obstacles to the use of insects as animal feed arise due to the risk of prion disease caused by feeding processed animal protein to the same animals. Sánchez-Muros, Barroso and Manzano-Agugliaro, (2014) and Shelomi (2020) were of the view that insect meals are less environmentally destructive and often cheaper than other ingredients of animal feed like soy and fish meal. Intergovernmental Panel on Climate Change (IPCC) (2019) reported that out of the 105,000 species studied, and increase in 1.50C of global mean surface temperature would lead to 6% of insects losing their climate determined geographical range. The report further pointed out that an increase to 20C would likely make insects the most vulnerable species at 18%, putting them ahead of plants 16% and vertebrates at 8%. However, this statistic calls for intensified efforts towards insect domestication to protect them from the adverse effect of climate change in their natural environment.

CONCLUSION

The scarcity of conventional feed materials (especially protein sources) resulting from increasing demand for animal protein due to global population growth drive the search for alternative protein sources. The potential of using Black soldier fly as an alternative in poultry feed is enormous; it has a greening potential as it works on organic waste to produce high level protein and lipids.

RECOMMENDATIONS

The following recommendations were made:

1. The use of BSF as an alternative for high protein component in livestock and fish feed production offers economic and environmental benefits. The potentials are enormous considering the land and resource requirements.
2. Smallholders with small land allocation should be encouraged to practice it.

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DEMAND ANALYSIS FOR BEEF AND PORK CONSUMPTION AMONG HOUSEHOLDS IN PORT HARCOURT CITY OF RIVERS STATE, NIGERIA

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ABSTRACT
The study examined the determinants of demand for beef and pork by households in Port Harcourt City, Rivers State, Nigeria. Specifically, the objectives described respondents' socio-economic characteristics; examined the factors influencing the demand for beef and pork and lastly and comparatively assessed their demand and consumption by respondents. The study achieved this by disseminating copies of structured questionnaire to households to elicit data on their preference, as well as the reasons and constraints to their demand, thereby making recommendations that would help improve their meat-protein intake. Data were generated from 100 respondents in the study area using simple random sampling procedure. Descriptive and inferential statistics were employed in data analysis. The result on socio-economic characteristics indicated that majority (76%) of the respondents were females within the age category of 21-30years (34%). Also, majority (72%) experienced tertiary education's with and mean of 7 persons per household, while majority (78%) of the beef consumers had the highest preference compared to that of pork (22%). The study therefore recommends that policies and programmes aimed at enhancing the availability of beef and pork at reduced cost should be implemented. More so, aids in the form of grants, loans and subsidies should be given to the key players.

Keywords: Demand, beef, pork, cattle, pigs, households, Nigeria

INTRODUCTION
Cattle and pigs are livestock animals reared basically for meat consumption. Studies have shown that meat is a major protein source and about 200g of it per day in human diet is required for healthy living by humans in developing countries (Food and Agriculture Organization, 2018). Cattle production is predominant in the Northern part of Nigeria, while pork is predominant in the Southern region (Anyanwu, 2012). This variance in its distribution is as a result of some socio-economic, climatic and religious factors. Islamic religion prohibits the consumption of pork, whereas the climate favours cattle production and agribusiness. This does not necessarily mean that pig production would not thrive well in the North seeing that the North produces enough food that could be channeled into feeding the pigs compared to Southern Nigeria (Mokoele, 2015).

The demand for both products takes into consideration the income distribution of households, how much of the income is allocated to meat purchase and the prevailing market price of the products per kg in Port Harcourt Local Government Area. Anyanwu *et al.* (2012) carried out a study that showed that animal protein is important for human body development, both physically and mentally. He further stated that animal protein deficiency could result to high incidence of infant mortality and malnutrition and the rate of consumption of protein when compared to the required level is low in Nigeria (Kuku-Shittu *et al*., 2016). This is because many Nigerians cannot afford the animal protein which is richer in amino acid compared to the close substitute fish and egg which are more affordable.

According to Nwachukwu and Udegbunam (2020) beef is consumed more and available to consumers compared to its close substitutes which includes pork, basically due to its production and distribution, pigs need to be reared and fed incurring high cost compared to

cattle that graze on fields. Also, the rate on conversion of feed to meat is higher in cattle compared to pig (Food and Agriculture Organization, 2017).

Nutritionally, beef and pork provide protein that aid in growth and repair of body tissues. They are also rich in different vitamins, minerals, micronutrients and fats and also aid in body metabolism such as the absorption of iron and zinc. With the awareness of its nutritional value, the demand for beef is ever on increase with increase in population. Prices of animal product are beyond the reach of the average Nigerian due to the increase in production and maintenance cost of farm animals. Despite this increase in the cost of animal products, the demand is still believed to increase annually with population increase and level of income coupled with the fact that animal protein intake is needed for healthy living (Henchion *et al.,* 2017).

A major problem government bodies and policy makers face in Nigeria is how to improve household food intake. Household foods in terms of quality and quantity of the food as well as seeking to address the problem of malnutrition and nutritional imbalance in the growing population of the country (Iwuchukwu *et al.,* 2015). Esobhawan (2008) has stated that Nigeria is highly deficient in animal protein security with the per capita consumption estimated to be 9.3g per day compared to the recommended 34g per day by Food and Agricultural Organization (FAO) as the minimum requirement for healthy growth and development of the body (Food and Agriculture Organization, International Fund for Agricultural Development, United Nations for International Children's Emergency Fund, Wood Food Programme and World Health Organization, 2018).

Baum *et al.* (2020) noted protein consumption is pivotal for a state of well-being of every individual. Despite the large livestock population in Nigeria, the daily per capita intake by Nigerians is 6grams, far below the 12grams stipulated by World Health Organization, WHO (Raghavendra, 2007).Siting that the low protein intake by many Nigerians can be traced back to the decline in livestock production, both correlating recent findings by Oladimeji (2017).

Despite the favorable policies and programs put in place by the federal government of Nigeria in improving the livestock industry and the meat production in particular, there has been little result achieved in this direction (Bennett *et al.,* 2018)

In order to tackle the problem of protein intake deficiency, we must strive to raise the level of animal protein consumption in our food menu (Verbeke & Vackier, 2004). One way of doing this is by improving the knowledge of what people eat and the factors influencing their demand for certain foods. There is need for the supply of the right quantity and mix of nutrients to the body because nutrients have been found to have a strong empirical linkage with both human health and productivity (Sushchik *et al.,* 2017). This implies that a healthy and nutritionally well-fed population is pivotal for attaining economic growth and development in any country and yet there are persistent reports on widespread malnutrition among Nigerians. Beef and Pork are two major sources of animal protein and if its production is improved upon can help reduce or eradicate the problem of malnutrition in the nation (Gillespie & van den Bold, 2017).

The study sought to ascertain the household demand for beef and pork in relation to household income and price of products, identify factor influencing household demand in Port Harcourt and make suggestions on how to aid policy agencies on increasing the protein level in the nation.

METHODOLOGY

The study was conducted in Port Harcourt City of Rivers State, Nigeria. The area can be described as a major metropolitan city in South-South geopolitical zone of Nigeria. It is referred to as the administrative capital of Rivers State, which is situated in the Niger Delta region of Nigeria. The area lies between 4.75°N and 7°E with network of rivers and tributaries (for e.g., New Calabar, Orashi, Bonny, Sombrero and Bartholomew Rivers) which provide great opportunity for fish farming.

From registered population of households in Port Harcourt Local Government Area, 100 households (20 households each) were randomly selected from the five (5) randomly selected communities in the study area.

Well-structured questionnaire were used in data collection. The copies of questionnaire were divided into four sections to capture the specific objectives of the study. Primary data were collected through the administration of questionnaire, Focus Group Discussion (FGD) and observations at the field. Data were analysed using descriptive and inferential statistical tools. The descriptive tools include mean, percentages and frequency counts while the inferential tools involved the use of Ordinary Least Square Multiple regression analysis

Ordinary Least Square Multiple Regression analysis

The implicit forms of the regression model is expressed as:

$Y_b = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, e)$ ..... (1)

$Y_p = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, e)$ ..... (2)

$Y_f = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, e)$. ..... (3)

The explicit form given as

$Y = f(x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + e)$ …… (4)

Where,

Yb, Yp = household consumption of beef and pork, respectively (kg)

X_1 = gender of consumer (D: 1=male; 0=female)

X_2 = age of respondent (years)

X_3 = educational attainment (years)

X_4 = marital status (D: 1= single; 0= married)

X_5 = household size (number of persons)

X_6 = Taste and preference

X_7 = own price of beef (naira)

X_8 = own price of pork (naira)

X_9 = income(naira)

e = error term.

The relationship between dependent and independent variables can be examined using four functional forms, linear, semi log, double log and exponential function, giving the following explicit equations.

Linear function: $Y = \beta_0 + 1\ \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + e$

Semi log: $Y = Y = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + e$

Double log function: $\log Y = Y = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7 + \beta_8X_8 + \beta_9X_9 + e$

Exponential function: $\log Y = Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + e$

β_0 = intercept

$\beta_1, \beta_2 \ldots \beta_9$ = estimated coefficients

The function that gives the best fit will be chosen, it must fulfill the following criteria; highest R^2 value, highest number of significant variables, highest F- value and conformity to *a priori* expectation of coefficients.

5-Point Likert Scale

In analyzing the constraints influencing the demand for both meats, we make use of Likert scale in showing how the respondents rate the constraints. This will help in deriving the result as to whether the constraints are most influential or least influential based on demand for beef and pork.

The rating points on the scale adopted were 1, 2, 3, 4 and 5.

Where

1= very low; 2 = low; 3= moderate; 4= high; 5= very high;
We make use of the following decision rules 3.0
5 + 4 + 3 + 2 + 1/n
Where n = 5
15/5 = 3.0
In ranking the constraints, we made use of the formula
$R_5F_5 + F_4R_4 + F_3R_3 + ... F_1R_1 / n$ to find the mean
Where n = 100
R (1, 2, 3, 4, 5) = Rating (1, 2, 3, 4, 5)
F (1, 2, 3, 4, 5) = Frequency (1, 2, 3, 4, 5)

RESULTS AND DISCUSSION

Regression Results for Quantity Demanded of Pork and Beef

The Regression Results for Quantity Demanded of Pork and Beef is presented in Table 1.

Table 1: Regression Results for Quantity Demanded of Pork and Beef

Explanatory variables	Linear	Semi-log	Double-log	Exponential
Constant	-30.479 (-3.103)	-142.592 (-2.011)	-27.183 (-2.686)	-2.076 (-1.919)
Gender	-0.298 (-0.429)	-1.043 (-0.453)	-0.286 (-1.215)	-0.095 (-1.573)
Age	-0.093 (-0.329)	-0.330 (-0.249)	-0.220 (-1.390)	-0.052 (-1.963)*
Educational attainment	-0.008 (-0.021)	-0.351 (-0.164)	0.246 (0.288)	0.005 (-0.056)
Marital status	-0.208 (-0.568)	-1.703 (-0.233)	0.045 (0.247)	-0.002 (-0.064)
Household size	0.034 (0.219)	0.233 (0.169)	0.108 (0.588)	0.014 (0.922)
Preference	10.309 (12.028)**	34.044 (12.054)**	-1.395 (-1.871)*	-0.263 (-1.266)
Price of beef	0.003 (0.409)	0.411 (0.409)	5.348 (2.156)**	0.003 (2.830)**
Price of pork	0.012 (1.953)**	34.914 (1.716)*	3.560 (1.377)	0.001 (1.157)
Income	9.659E-006 (3.311)**	2.851 (3.367)**	0.249 (0.097)**	1.392E-006 (3.312)**
R^2	0.734	0.736	0.755	0.822
R^2 adjusted	0.707	0.709	0.586	0.700
F-ratio	27.257	27.544	4.462	6.691

***Note**: ** significant at 5%, *** significant at 1%, * significant at 10%*
Source: Computed from Field Survey Data, 2015.

Table 1 shows the regression results of the analysis on demand for pork and beef in the study area. From the model, four (4) functional forms were used for the regression. They are linear, semi log, double log and exponential and their coefficients of multiple determination were 0.598, 0.593, 0.370 and 0.344, respectively. The linear function was chosen as the lead equation due to its statistical significance which formed a basis from the economic theory that supported the consumption function.

As indicated in Table 1.0, the coefficient of multiple determination which is 0.598 implies that about 59.8% of the variation in the quantity demanded in the study area is accounted for by the explanatory variables. In other words, preference and income indicated high significance at 5%, which implied that both factors influenced the demand for beef in the study area. Therefore, the price of beef is not statistically significant at any level of probability; hence, beef price is clearly not a significant determinant of demand for beef in the area. It is therefore, negatively related to the quantity of beef demanded which means that an increase in the level of for beef will lead to a commensurate decrease in the quantity demanded of it in the study area. The price of pork showed signs of negative correlation which clearly implied that an increase in the pork price as a close substitute will also cause an increase in beef demand.

The age of beef consumers indicated a positive relationship to the quantity of meat demanded, which implies that the older the respondents the more meat they demand contrary to the meat demand for the younger ones. This conforms to the findings of Anyanwu *et al.* (2012) which states that children move from consuming milk as a source of protein to meat in most households. Household size is described as insignificant since it is a determinant factor, which makes it impossible for all members of the household to exercise preference for beef irrespective of its negative correlation with household size; an implication that the larger the household size, the lower the quantity of beef demanded. This can therefore be justified due to the fact that the larger the household size, the more likely it is to its primary source, since it is a cheaper alternative protein source like fish and egg.

Educational attainment is also a statistically insignificant variable in the area. This implies why the lowly and highly-educated consumers of meat are negatively correlated, which is indication that the more enlightened the people are about beef, the lesser of its consumption they would go for less-fatty protein alternatives like fish and chicken.

Due to the inelasticity in the prices of beef and pork, a -0.002 increase in the price of beef will lead to a unit decrease in the quantity of beef demanded. On the other hand, a 0.012 increase in the price of pork will cause a unit increase in the quantity of beef demanded. In their findings, Nwachukwu & Udegbunam (2020) made a similar observation.

Pork Consumption

More so, results on the linear model show that in the linear model, three explanatory variables were statistically significant at 5% level of probability. The coefficient of multiple determination are stated thus: 0.734, 0.736, 0.755 and 0.822, for linear, semi log, double log and exponential respectively, the linear function was selected as the lead equation for analysis of the demand for pork. The coefficient of multiple determination for pork 0.734 implies that the explanatory variables explain about 73.4% of the variations in the quantity of pork demanded in Port Harcourt local government area.

From the result, preference, income and own pork were statistically significant at 5% level of significance in the study area. Preference is positively correlated with the quantity of pork demanded which implies improving the preference of pork would increase its demand. Income was positively correlated with the demand for pork which implies that the higher the income of the household head, the more likely they are to consume pork. Owned price of pork is another significant determinant in the study area, it is positively correlated which implies that an increase in the price of pork results in an increase in the demand but note that the value 0.12 can be used to show the response to be positive but inelastic. Also, price of pork correlates

positively with quantity demanded for pork portrays an attribute associated with ostentatious commodities. Price of beef is positively correlated but not significant, this means that increasing the price of beef in the area will not significantly increase the quantity of pork demanded in the area. Age is negatively correlated, implying that the older the population, the less the demand for pork, this can be attributed to nutritional and health reasons.

Price of beef and pork are inelastic, 0.003 increase in the price of beef will lead to a unit increase in the quantity of pork demanded and 0.012 increase in the price of pork will cause a unit increase in the quantity of pork demanded. In his study on smallholder fresh fish marketing enterprise, Agbugba (2018) made a similar observation.

Constraints to Beef and Pork demand by Households

In analyzing the constraints influencing the demand for both meats, the results are presented in Tables 2 and 3. Results indicated that the constraints on the demand for beef were ranked using 5-Point Likert rating scale.

Table 2: Ranking of the Constraints for Beef

Constraints	Mean	Rank
Unavailability of beef	2.27	3rd
Lack of fund	2.27	3rd
Unavailability of market	2.02	5th
Price of beef	2.55	1st
Health implication	2.41	2nd
Religious implication	1.83	6th
Total	100	100

Source: Field Survey (2015)

From Table 2, results indicated that the constraints were presented in the order of importance as it pertains to the respondents in the study area. However, using the mean 3.0, constraints >3.0 has a significant influence on the demand for beef, while the constraints < 3.0 has no significant influence on the demand for beef.

The results showed that the price of beef is the highest constraining factor on demand for beef in the study area with 2.55, followed by health implication with 2.41, and the unavailability of beef, lack of fund and religious implication with 2.27, 2.27 and 1.83 respectively.

From the result, all the constraints had no significant influence on the demand for beef. This implies that there is good demand for beef by households in the study area.

The constraints on the demand for pork were ranked using the Likert scale in their order of importance as it pertains to the respondents in the study area.

Table 2: Ranking of the Constraints for Pork

Constraints	Mean	Rank
Unavailability of pork	3.75	1st
Lack of fund	2.74	6th
Unavailability of market	3.01	4th
Price of beef	3.39	3rd
Health implication	3.40	2nd
Religious implication	2.82	5th
Total	100	100

Source: Field Survey (2015)

From Table 3, results shows that unavailability of pork, price of pork, unavailability of pork and health implications (3.75, 3.39, 3.01 and 3.40 respectively) have significant influence on demand for pork since they are above 3.0, whereas lack of fund (2.74) and religious implication (2.82) do not have significant influence on demand for pork in the study area.

The result shows that there are many significant constraints influencing pork than beef in the study area, this can contribute to its low demand in the study area. Health implication ranks 2nd with 3.40. This can be attributed to the high level of cholesterol contained in pork. This correlates with research findings by world health organization that the consumption of beef and pork is hugely influenced by medical and health concerns, its consumption is known to increase the risk of bowel and lung cancer (Huang *et al.,* 2021).

Comparative Assessment of the Demand for Beef and Pork

Results from the analysis using the linear model indicates that income and preference were significant for quantity demanded of beef and pork. Price of beef was not a significant factor for both products, whereas the price of pork was significant for quantity of pork demanded and insignificant for quantity of beef demanded. Educational attainment was negative on both tables, which implies that an increase in the level of education of the population will cause a decline in the quantity of beef and pork consumed. Other socio-economic factors such as age, gender, marital status and household size showed a positive and negative interaction; hence none was significant in determining the quantity of beef and pork.

CONCLUSION

The study posits that income, preference, price of pork and beef meats, as well as other socio-economic features play a key role on the consumption and quantity of beef and pork demanded by households in Port Harcourt Local Government Area of Rivers State, Nigeria. As a matter of fact, beef and pork meats are very important sources of protein due to their high nutritional quality and significance in improving human nutrition and health.

RECOMMENDATIONS

Hence, it is therefore important that as a major source of protein, steps should be taken to ensure that they are made available to the people. Efforts should be made by pig farmers to create cooperative societies towards the efficient management of pig farmers within each community so to bridge the gap of increase demand in pork meat in the area. State government should provide agricultural support systems for pig farmers in these rural communities to expand to meet demand, alongside better market channels for pig farmers to sell their produce. To encourage expansion to meet the demand, government should also increase access to subsidized loans and credit facilities for pig farmers to enable them to increase their output and subsidize the cost of feedstuffs for the pig farmers to increase productivity. In addition, Pig breeders should establish programmes that will enhance indigenous preservation of germlines and potentially useful traits of pigs through on-farm and ex-situ conservation. More so, younger generations should be incentivized in livestock farming and given improved training programmes on effective health management for better productivity and job creation.

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ANALYSIS OF MARGINS, CHANNELS AND CONSTRAINTS TO SNAIL MARKETING IN OBIO-AKPOR LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

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ABSTRACT
The study investigates the economics of snail marketing in Obio-Akpor Local Government Area, Rivers State, Nigeria. The specific objectives of the study were to determine the marketing margin in snail marketing, estimate the profitability, describe the marketing channels, and identify the perceived constraints in snail marketing. The study used multi-stage sampling technique to select 110 snail marketers from the study area. Primary data were sourced from well-structured questionnaire. Data for the study were analyzed using descriptive statistical tools such as mean, percentage and frequency. Gross margin model and multiple regressions analysis were also employed in data analysis. The results of costs and return analysis showed that wholesalers and retailers received an average monthly profit of ₦55,195.7 (134.15USD) and ₦26,564.42 (64.56 USD) respectively. The estimated marketing margin stood at 14.89% and 23.03% for the wholesalers and retailers respectively. Furthermore, the study identified three snail marketing channels in the study area and also identified snail perishability (92.5%) as accounting for the most serious problem faced by the respondents. It was recommended, among others, that government and well-meaning institutions should embark on workshop exercise to educate snail farmers and marketers on how best and efficient safe practices for keeping snail so as to avoid incessant cases of perishability.

Keywords: Snail, margins, channels, constraints, marketing, Nigeria

INTRODUCTION
Snail marketing is gradually becoming popular, especially since the advent of snail domestication in this part of the world (Ebewore & Achoja, 2012). This development could be owing to the need to bridge the gap between protein requirement and actual protein consumed by the people (Ciric *et al.*, 2018). There is a flourishing international trade of snails in Europe and North America. In France, the annual requirement is about 5 million kg, over 60% of which is imported; the estimated annual consumption in Italy is 306 million snails. In west Africa, snail meat has traditionally been a major ingredient in the diet of people living in the forest belt. In Cote D'Ivoire for example; an estimated 7.9 million kg is consumed annually. In Nigeria, Enugu state in particular, snail's farmers are very few. Taboos over snail production, consumption and marketing are broken in many places. The few farmers farm in small-scale (Vukašinovic-Pešic, 2017).

Snails are said to have high protein content and medically valuable and so for these reasons, the demand for snail meat has increased over the years in both domestic and foreign markets. According to Vukašinovic-Pešic (2020) snails have been and are still a much sought-after food and come to the table as a gastronomous delight. The high iron content of snail meat is considered important in the treatment of Anaemia and also for combating Ulcer and Asthma (Efarmspro 2008). According to Amao *et al.* (2007), snail meat is recommended in the past for treatment of ulcer, asthma and even at the imperial court, in Rome it was thought to contain aphrodisiac properties (arousing or increasing sexual desire) and was often served to visiting

dignitaries in the late evenings. For instance, the feasibility of using snail meal of the giant African snail as a partial fishmeal substitute in raising fish such as *Clarias gariepinus* (Cobbinah *et al.,* 2008). Snail meat is used for different curative purposes from ancient times till today using several formations. For example, it can be a remedy to treat burns, abscesses and other wounds, measles, smallpox, and some skin disease, (Bayode, 2009). According to Leeflang (2005 cited by Ahmadu & Ojogho 2012) snails also fit in well with other farming activities helping to fertilize the soil prior to cultivation of other crops. Ahmadu & Ojogho (2012) noted that snail enterprise provides employment opportunities and income for the snail producers and marketers. In Ghana, the bluish liquid obtained in the shell when the meat has been removed is believed to be good for infants‟ development. Slime from snail can be collected and used to cure eczema, skin rashes, swells, burns and insect bites. Also, it is used as an antihypertensive agent especially slime of Achatina species (Ugwumba *et al.,* 2016).

According to Drozd *et al.* (2017) there is a growing demand for snail locally and internationally. In local markets in the study area, market price per snail is rising due probably to rising population, increasing demand and decreasing supply, hence widening demand-supply gap. This widening demand-supply gap can be attributed to the existence of inefficiency in the marketing system due to marketing problems such as lack of marketing information, poor market structure, high cost of transportation, lack of capital, poor storage facilities, limited markets and large number of intermediaries (Ugwumba & Obiekezie, 2008; Ugwumba & Okoh, 2010). Among these problems the chances of viability in the marketing of snail should appear bleak. However, snail marketing could serve as a source of income to the marketers, as Reardon & Timmer (2005) would note that marketing offers households the opportunity to specialize according to comparative advantage and thereby enjoy welfare gains from trade. They added that recognition of the potential of marketing as engines of economic development and structural transformation gave rise to a marketed paradigm of agricultural development during the 1908s. Thus, investigating the economic analysis of snail marketing is therefore pertinent

The broad objective of this study is to analyze the margins, channels and constraints of snail marketing in Obio-Akpor Local Government Area (LGA) of Rivers State, Nigeria. The specific objectives supporting the study are to determine the marketing margin in snail marketing in the study area; estimate the profitability of snail marketing;identify the marketing channels of snail marketing; and, identify the perceived constraints in snail marketing.

METHODOLOGY

The study was conducted in Obio/Akpor LGA of Rivers State, Nigeria. Obio/Akpor LGA is one of the two LGAs in Port Harcourt metropolis, Rivers State. It can be described as few urban towns and several suburban communities is bounded by Port Harcourt LGA to the South, Oyigbo to the East, Ikwerre to the North, and Emohua to the West. It is located between latitudes 4°45'N and 4°60'N and longitudes 6°50'E and 8°00'E (Figure 1). Port Harcourt is the administrative capital of Rivers State, in the Niger Delta area of Nigeria. Port Harcourt lies between 4.75°N and 7°E with network of rivers and tributaries (for e.g., New Calabar, Orashi, Bonny, Sombrero and Bartholomew Rivers) which provide great opportunity for fish farming (Agbagwa *et.al.,* 2021). Obio/Akpor L.G.A is one of the Agricultural Zones of Agricultural Development Programs of Rivers State (Ibemere & Ezeano, 2014). Crop farming (e.g yam, cassava and vegetables) is the principal source of livelihood. There are also rivers, streams, and creeks which make fishing one of the occupations. These water bodies link the various communities to each other. More recently is the population increase triggered by urban sprawl and the infrastructural development (the tertiary institutions - University of Port Harcourt, Choba and Ignatius Ajuru University of Education, Rumuolumeni and two important jetties at Rumuolumeni and Choba, respectively) in the area (Amachree *et al.*, 2019).

Purposive and simple random sampling technique was employed for the study. Firstly, four markets will be chosen in the study areas *viz.*: Rumuomasi Main market, Oil Mill market, Rumuodumaya market, and Oginigba Slaughter market. This selection is owing to the significant scale of snail marketing activity they are associated with. Secondly, simple random sampling technique was employed in choosing snail marketers across these markets in the following order; Rumuomasi Main market (25), Oil Mill market (25), Rumuodumaya market (25), and Oginigba Slaughter market (25). Thus, a total of 100 snail marketers formed the sample size for the study. Table 1.0 summarizes the procedure of the sampling.

Table 1: Summary Procedure for Sampling

S/N	Market	Wholesalers	Retailers	Number of Respondents
1	Rumuomasi Main market	10	15	25
2	Oil Mill market	10	15	25
3	Rumuodumaya market	10	15	25
4	Oginigba Slaughter market	15	20	35
	Total	**45**	**65**	**110**

Source: Researchers' Initiative

Primary data were collected using well-structured questionnaire and interview schedule. The questionnaire was divided into sections to capture the specific objectives of the study.
Data were analyzed using descriptive statistics such as frequency distribution and percentages. Marketing margin analysis and Gross margin model were also used for data analysis.

Marketing Margin Analysis
It is expressed as:
$MM = CP - RP / CP \times 100$

Where:
MM = Market margin (₦)
CP = Consumer Price (₦)
RP = Retailed Price (₦)

Gross Margin Model
The model is specified as:
$GM = TR - TVC$ (7)

Where:
GM = Gross margin
TR = Total revenue
TVC = Total variable cost
TFC = Total fixed cost
π (profit) = GM- TFC

RESULTS AND DISCUSSION
Cost and Return Analysis and Marketing Margin Estimation
Table 2 provides a detailed analysis of the cost incurred and return realized by the marketers of processed catfish in the study area. The marketers of the product were categorized into either wholesaler or retailer. According to Aghazadeh (2016), two important parameters in marketing analysis include marketing cost and revenue.

Table 2: Costs/Returns and Marketing Margin estimates of Snail Marketing in the Study Area

Items	Wholesalers' Value (₦)	Retailer Value (₦)
Total Revenue (TR)	**503244.4**	**244612.3**
Variable Cost (VC)		
Cost of snail	401733.3	179480.62
Transportation	24644	21838
Tax/levy	1508.82	1306.15
Loading/unloading	835.56	514.81
Labour	10548.39	9368.42
Packaging	5122.22	1360
Total Variable Cost (TVC)	**443640.29**	**213868**
Gross Margin (GM)	59604.11	30744.3
Fixed Cost (FC)		
Depreciation	194.35	107.08
Rent	3829.62	3705.11
Security fee	384.44	367.69
Total Fixed Cost (TFC)	**4408.41**	**4179.88**
Total Cost	**448048.7**	**218047.88**
Profit	**55195.7**	**26564.42**
Net return on Investment (NROI)	**1.12**	**1.12**
Marketing margin	**7444.44/bag**	**14392.31/bag**
Marketing margin (%)	**14.89**	**23.03**

Source: Field Data Analysis, 2019; *Wholesaler: Average cost of snail/bag = ₦* 42555.56*; Selling price =* ₦50000.00; *Retailer: Average cost of snail/bag =* ₦48108*; Selling price =* ₦62500.00; *NROI = TR/TC*

Wholesalers of snail in the study area received an average monthly return of ₦503,244.4 (1,223.02 USD). However, they incurred an average total variable cost of ₦44,3640.29 (1,078.16 USD) monthly, thus given rise to an average gross margin of ₦59,604.11 (144.85 USD). In the same vein, they incurred an average total fixed cost of about ₦4,408.41 (10.71) monthly. Total fixed cost was obtained from the sum of the average monthly cost on depreciation, rent, and security fee incurred by the marketers. The average monthly profit of a snail wholesaler in the study area was estimated at ₦55,195.7 (134.14 USD). In addition, the net return on investment was estimated at 1.12. This may mean that for every ₦1.00 invested in snail marketing by a wholesaler, ₦1.12 return was realized.

Similarly, the retailers recorded an average monthly return of ₦244,612.3 (594.47 USD) which was followed by an average monthly variable cost and fixed cost of ₦213,868 (519.76 USD) and ₦4,179.88 (10.16 USD) respectively. Average monthly gross margin and profit to the retailers were estimated at ₦30, 744.3 (74.72 USD) and ₦26, 564.42 (64.56 USD) respectively. Furthermore, just like their wholesaler counterpart, the retailers had net return on investment of 1.12 which would still mean that for every ₦1.00 invested in snail marketing by a retailer, ₦1.12 return is realized.

Overall, it can be surmised, that snail marketing business in the study area is profitable. Mafimisebi *et al.* (2013) agrees with the finding, also in consonance with this finding is the report of Aderounmu *et al.* (2019), whose work was on economic analysis of snail marketing in Ibadan North East LGA of Oyo State, Nigeria. More so, this argument is confirmed by Ebenso (2007). Alongside Ajala and Adesehinwa (2007), they see snail marketing as a profitable agribusiness, below poverty line.

More so, the marketing margin analysis in Table 2 showed that snail wholesalers enjoyed an average marketing margin of ₦7,444.44 (18.09 USD) at an average cost of ₦42, 555.56 (103.42) per bag snail and a selling price of ₦50, 000.00 (121.51 USD) for the same bag.

Percentage marketing margin of 14.89% was estimated for the wholesalers. However, the at an average cost price of ₦48, 108.00 (116.92 USD) per bag and a ₦62, 500.00 (151.89 USD) selling price for the same price, the gross margin for retailers was estimated at ₦14,392.31 (34.98 USD) and their Percentage marketing margin was at 23.03%.

Marketing Channels of Snail

Table 3 shows the distributive channel of snail in the study area as cutting across the producer, wholesaler, retailer and consumer. Supporting the table, is a chart in Fig 1.0 which further explains snail marketing channel in the study area.

Table 3.0: Percentage Distribution by Channels of Snail Marketing in the Study Area

Channels	Scores	Percentage
Producer → Wholesaler → Retailer → Consumers	82	42.7%
Producer → Retailers → Consumers	28	14.6%
Producer → Wholesalers → Consumer	82	42.7%
Total	**192**	**100.0**

Source: Field Survey, 2019; **Multiple responses*

Table 3 shows the market channel of snail in the study area. The main marketing channels were identified in the study area. Six (6) marketing channels were identified in the study area. The first channel indicates the movement of the product from the producer through the wholesaler and retailer to the consumer and it stood at 42.7%. The second channel depicts the flow of the product from the producer through the retailer only and finally to the consumer, it recorded 14.6%. Finally, the third flows from the producer through the wholesaler and then to the consumer and had 42.7%.

An illustration of the marketing channel for the snail marketers is shown on the Figure 1.0 below buttressing the movement of snail from the producer to the consumer through the various middlemen.

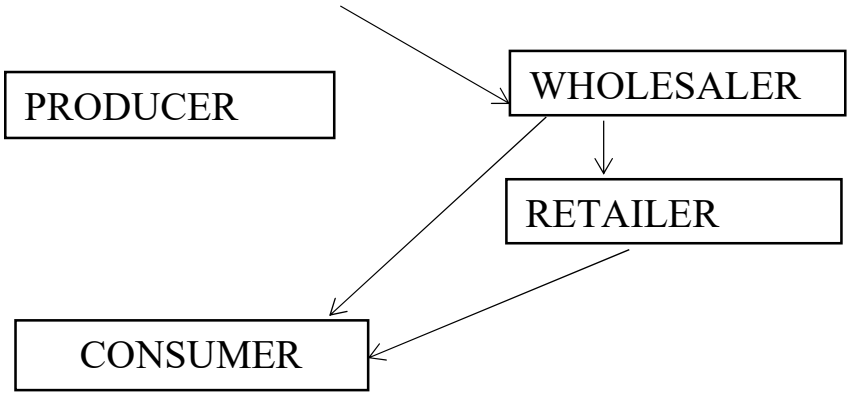

Fig 1.0: Marketing Channel for Snail in the Study Area
Source: Researcher's Initiative

Constraints to Snail Marketing

Ranking of perceived constraints militating against snail marketing is expressed in Table 4.0.

The Table presents the various perceived constraints as identified by the participants. Percentages used to present the constraints in their order of magnitude. From the Table,

perishability (92.5%) accounted for the most serious problem faced by the respondents in the stud.

Table 4: Distribution of Respondents according to perceived Constraints to Snail Marketing (n=110)

Constraints	Frequency	Percentage (%)	Rank
High transport cost	9.2	28.0	5
Price Fluctuation	21.5	65.4	2
Inadequate supply	12.3	37.4	4
Numerous sellers	6.1	18.7	6
Lack of finance	14.4	43.9	3
Storage facility	6.1	18.7	6
Perishability	30.4	92.5	1

Source: Field Survey, 2019; **Multiple responses*

This result is supported by Ebewore & Achoja (2012), in their study titled Economics of Snail Marketing: Implications for Extension Service Delivery in Delta State, Nigeria. Chagomoka *et al.* (2013) indicated that, high perishability of indigenous vegetables is a principal challenge in the marketing and distribution of the produce. Price fluctuation ranked second at 65.4%, and was followed by the lack of finance which recorded 43.9%. In their study on maize marketing, Agbugba *et al.* (2020), identified lack of finance as a serious constraint, whereas problem of inadequate supply (37.4%) posed a major constraint. On the other hand, Agbugba & Shelaby (2018) submitted that limited supply, paucity of capital and spoilage are major problems. In essence, high transport cost scored 28.0%, while problem of numerous sellers and that of storage facility were jointly ranked sixth at 18.7%.

CONCLUSION

The study concludes that marketing of snail is profitable and veritable business venture for the key players and is also dominated by females. The study equally estimated the marketing margin to be at 14.89 % and 23.03% for the wholesalers and retailers, respectively; thereby establishing that the socio-economic characteristics of the marketers influenced the marketing margins of the snail dealers in the study area The study identified three distributive channels in snail marketing of snail in the study area. However, despite the fact that marketing of snail is profitable, there are lots of challenges faced by the marketers. Among other bottlenecks, perishability ranked first as the typical problem facing the marketers. This may mean that the performance of the marketers in relation to their cost and return on investment is affected by the identified problem.

RECOMMENDATIONS

The study makes the following recommendations based on the findings:

i. Government and relevant stakeholder can use snail marketing as a means of empowering restive and unemployed youths considering that snail marketing by this study is profitable.
ii. Government and should embark on a workshop to educate snail farmers and marketers on best safe practices of keeping snail to avoid incessant cases of perishability.
iii. Affordable credit facilities should be provided by the government so that willing marketers can access them to improve on their business.

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FACTORS INFLUENCING LEVEL OF ADOPTION OF RISK MANAGEMENT STRATEGIES AMONG ARABLE CROP FARMERS IN IMO STATE, NIGERIA

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ABSTRACT
The study analyzed the factors influencing the level of adoption of risk management strategies among arable crop farmers in Imo State. The specific objectives were to describe the socio-economic characteristics of the arable crop farmers in the study area, identify the risk management strategies among arable crop farmers in the area, and estimate the factors that influence the level of adoption of risk management strategies among arable crop farmers. Multistage sampling technique was employed in the selection of the 60 arable crop farmers from the study area and data were collected using structured questionnaire. Data were analyzed using descriptive statistics, use of frequency table and percentage, as well as Tobit regression model. The result showed that the mean age of the arable crop farmers were discovered to be 39years. Majority (60%) of the farmers were males and greater percent (56.66%) of them were married. Diversification of income and crops and application were the major risk management strategies practiced by the farmers in the area. The result of the Tobit regression revealed that farming experiences, educational level household size, occupation and level of income influenced the likelihood of adoption of risk management strategies among arable crop farmers in the study area. The study recommended the provision of access to educational facilities for the farmers to increase their knowledge about risk management strategies.

Keywords: *Risk Management Strategies, arable crop farmers, adoption*

INTRODUCTION
Agriculture employs about two-third of Nigeria's total labour force, contributed 42.2% of Gross Domestic Products (GDP) and provides 88% of non-oil earnings (Yakubu & Akanegbu, 2015). Agriculture could be said to be the mainstay of many economies and it is fundamental to the socio-economic development of a nation because it is a major element and factor in national development (Olaoye, 2014). Arable crops are staple agricultural crops which provide the required nutrients for man and livestock. Within the agricultural sector itself, the crops sub-sector is the largest, with arable crop production dominating about 30 percent of overall GDP (Central Bank of Nigeria, 2016). Over 90 percent of the agricultural output in the country is from smallholder farmers who cultivated less than two hectares of land. It is estimated that out of 68 million hectares of the total land area which has potential for agricultural activities, only about 33 million hectares is under cultivation. Over the years, Nigeria has devoted large hectare to the cultivation of arable crops, however, productivity has remained low, a phenomenon that has entangled the farmers in a vicious circle of poverty. Among factors accounting for the low productivity of these farmers are, the use of obsolete cultural practices, scanty plant stands, poor weed control, non-usage of fertilizer, organic manures and other improved agricultural inputs including the management of the crop under degraded soil condition (Food and Agriculture Organization, 2003).

Farming is risky and farmers live with risk and make decisions every day that affect their farming operations. Many of the factors that affect the decisions that farmers make cannot be predicted with 100 percent accuracy: weather conditions change; prices at the time of harvest could drop; hired labour may not be available at peak times; machinery and equipment could break down when most needed; draught, animals might die; and government policy can change overnight (FAO,

2013). Globally, farmers deal with a significant amount of uncertainty all day long. From not knowing what the vagaries of weather will be like now, to wondering if market prices will increase or decrease the next moment and even to not knowing if pests and diseases will attack his promising various crops and livestock enterprise tomorrow. Therefore, farmers are forced to make decisions based on imperfect information and knowledge. Born out of this uncertainty is the possibility of agricultural injury or loss. The term "Risk" is used to describe a combination of the probability of an event and its consequences (Hatz, 2016). Risk and uncertainty are ubiquitous in agriculture and have numerous sources: the vagaries of weather, the unpredictable nature of biological processes, the pronounced seasonality of production and market cycles, the geographical separation of producers and end users of agricultural products, and the unique and uncertain political economy of food and agriculture within and among nations (Soham & Vikas, 2013). Risk management strategies are defined as the methods applied to remove or reduce partly the effect of factors creating risk in agriculture. To reduce effects of risk or survive in the poor conditions for farm activities, it is necessary to use risk management strategies. The selection of good risk management strategies depends on the farm operator, the financial situation and risk attitudes of the farmer (Korir, 2011). Risk management is and will continue to be a key driver of success in agriculture, preserve the standard of living of those who depend on agriculture, provide an environment which supports investment in the agricultural sector and strengthen the working capability of farm businesses (Organization for Economic Co-operation and Development, 2011).

Smallholder farmers face many risks in their farming activities; for example, in the past, the country has recorded drought, crop and animal diseases and pests as well as fluctuations in prices of both farm produce and inputs. As a result, there has been variability in farming household income. Though there has been the introduction of different agricultural interventions such as improved crop varieties and production technologies to increase yield, the impact of climate related and other forms of risk is still very costly for farmers. Farmers have dealt with production risk, economic fluctuations and individual specific shocks through self- insurance and a large array of informal coping strategies. These tend not to be very effective, efficient or profitable. As a result, risk management strategies of small holder farmers in developing countries might in fact push them into poverty (Ellis, 2017). According to Jose (2013), improvements in risk mitigation, transfer or coping can bring about large benefits to vulnerable arable crop farmers households. Hence, managing risk effectively is expected to increase arable crop farmers' profit. They therefore adopt a range of strategies to manage the risk they face. These strategies can be subdivided into strategies which might be loosely termed on-farm risk management strategies, business diversification strategies and strategies in which risks are shared with others. The risk management strategies include: collecting information, avoiding or reducing exposure to risk, selecting less risky technologies, diversification, informal risk pooling and insurance. The main objectives of this study were to describe the socio-economic characteristics of arable crop farmers in the study area, to identify the risk management strategies among arable crop farmers in the area, and to estimate the factors that influence the level of adoption of risk management strategies among arable crop farmers.

METHODOLOGY

Imo State is located in the South-Eastern area of Nigeria and it is bordered by Abia State on the East, by the River Niger and Delta State on the West and Rivers State to the South. This study was conducted in Southeast Nigeria, which is located between latitudes 40101N and 7 081N and

longitudes 50 301E and 90 271E. The principal food crops are yam, cassava, cocoyam and maize while the cash crops are cocoa, oil palm, groundnuts, rubber and cotton.

Data for this study were collected from both primary and secondary sources. Primary data were collected using well-structured questionnaire. Secondary source of data were obtained from textbooks, internet, library, journals, magazines, seminar papers.

Multi-stage sampling procedure was used to select arable crop farmers in the study area. In the first stage one agricultural zone was randomly selected from the three agricultural zones that make up Imo state. In the second stage, two local government areas were randomly selected from the selected agricultural zone. In the third stage two communities were selected from the two LGA, in the fourth stage one village was randomly selected from each of the two communities making a total of four villages for the study. In the final stage fifteen (15) arable crop farmers were chosen from the list of registered farmers with the assistance of community resident extension agent making a total of sixty (60) arable crops farmers.

Descriptive statistics such as frequency counts, percentages and mean values were used to describe selected socio-economic characteristics of the arable crop farmers while inferential statistics such as Tobit regression model was adopted to estimate the adoption of risk management strategies of farming households in the area of study.

The Tobit regression model is stated implicitly as:

$Yi^* = \beta Xi + ei$

$Y_i^* = 0$, if $Y_i = 0$

$Y_i^* = Y_i$ if $0 < Y \leq 1$

where:

Y_i^* is the observed dependent variable (Risk management strategies proxied by its' index);

β is a vector of unknown parameters;

X_i is the vector of independent variables;

where i = 1, 2.....n;

and the hypothesized explanatory variables are:

X_1 = age of the farmers (years)

X_2 = age squared (years) to capture the life cycle hypothesis

X_3 = years of formal education (years)

X_4 = farming experience (years)

X_5 = primary occupation (farming = 1, 0, Otherwise)

X_6 = household size (actual)

X_7 = social capital endowment (Yes =1, 0, otherwise)

X_8 = level of incomes

X_9 = monthly expenditure (₦)

e_i is a disturbance term assumed to be independent and normally distributed with zero mean and constant variance σ.

RESULTS AND DISCUSSION

The socio-economic characteristics of the arable crop farmers are presented in table 1

Table 1. Socio-economic characteristics of the arable crop farmers

Age (years)	Frequency	Percentage (%)
20 – 29	12	20
30 – 39	22	36.66
40 – 49	15	25

50 – 59	8	13.33
60 – 69	3	5
Mean	**39.1**	
Sex		
Male	36	60
Female	24	40
Marital Status		
Single	15	25
Married	34	56.66
Widowed	8	13.33
Divorced	3	5
Household size		
1 – 3	19	31.66
4 – 6	28	46.66
7 – 9	13	21.66
Mean	**5**	
Level of Educational (years)		
1 – 6	32	53.33
7 – 12	16	26.66
13 and above	12	20
Major Occupation		
Farming	42	70
Trading	10	16.66
Civil servant	8	13.33
Farming Experience		
Below 1	1	1.66
2 – 10	26	43.33
11 – 20	18	30
21 – 30	8	13.33
31 and above	7	11.66

Source: Field Survey Data ,2019

Table 1 shows the age distributions among the arable crop farmers in the study area. 36.66% of the respondent fell within the age bracket 30-39 while 25% of the respondents fell within the age bracket 40-49. This shows that the arable crop farmers are young, energetic and may be more willing to adopt risk mitigation strategies on their farms as a means of reducing losses due to risk. According to Shakirat et al*.,* (2015) age is generally believed to be an important factor in farming activities. This is because younger farmers are believed to commit more energy into production activities, while older ones are likely to be more experienced thus impacting positively on their productivity. The table also shows that majority of the arable crop farmers (about 60 percent) were male. This shows that males are more involved in farming in the study area than females. It may also be that male farmers adopt more risk mitigation strategies in arable crop cultivation of crop as also shown in the study. The table further shows that majority (56.66%) of arable crop farmers in the study area were married while 25% of the arable crop farmers were single. This indicates that a greater percentage of the farmers were married and may therefore be willing to adopt risk mitigation strategies that would reduce losses of their farms produce.

Table 1 further revealed that 46.66% of the farmers had household size of between 4-6 persons and the mean household size was about 5 persons. This result shows that farmers in the study area have a moderate household size and may need to hire labour to work on the farm. In terms of education, (53.33%) of the arable crop farmers attained primary school level of education while 26.66% had secondary school education and 20% had tertiary education. This indicates that more farmers in the study area were literate therefore they can accept new innovations and adoption strategies on how to avert risk in arable crop production in the area. The Table also shows that majority of the respondents (about 43.33percent) had between 2-10 years of experience in business, 30% had between 11-20 years' experience in business. This implies that the arable crop farming in the area is carried out by well experience farmers who can anticipate and calculate their risk and how to combat it.

Risk Management Strategy by the Arable Crop Farmers in the Area

The risk management strategies among the arable crops farmers is presented in Table 2

Table 2: Risk Management Strategy Practice the Arable Crop Farmers in the Study Area

Risk Adoption	Frequency**	Percentage
Diversification of income sources	26	59.09
Diversification of crop enterprise	18	40.91
Insurance	8	18.18
Early planting	11	25
Planting of early maturing crop varieties	13	29.55
Planting of disease/pest resistant crop varieties	17	38.64
Early harvesting	4	9.09
Use of organic fertilizer	16	36.36
Use of inorganic fertilizer	19	43.18

Source: field data 2019, **Multiple responses recorded

Table 2 above shows that majority (59.09%) of the farmers practice diversification of income in order to reduce risk of planting only arable crops. About 43.18% of the farmers make use of inorganic fertilizer as risk management strategy in the study area, while 40.91% of the arable crop farmers diversify their enterprise as a way of managing risk. Also, 18.18% of the arable crop farmers made use of insurance as a risk aversive strategy in arable crop production in the study are. This implies that to reduce risk, diversification of income crop enterprise, use of fertilizer and others are important in management of risk in the study area. Adnan *et. al.,* (2020) opined that due to the high level of education, farmers pay more attention to collect information on diversification, so as to increase farm earnings and constancy. This farming practice positively correlated with diversification decision. He further stated that experienced farmers have a tendency of choosing diversification for managing risk and more experience allows farmers to keep more information about disaster management. Ullah *et. al.,* (2014) in his research established a positive correlation between household income and off-farm diversification and negative correlation with on-farm diversification. The study concluded that the larger the farm, the greater the capacity to take risks. As a result, they are less likely in need of risk management strategies adopted.

Factors that influence the level of adoption of risk management strategy among arable crops farmers in the study area

The factors that influence the level of adoption of risk management strategy among arable crop farmers in the study area is presented in Table 3.

Table 3: Regression on the level of risk adoption strategy in the study area

Variables	Coefficients	t- test	Significant
Age	0.0233	0.60	Not
Age Squared	0.000157	-0.36	Not
Level of Education	0.01659	2.11**	5% level
Farming Experience	0.00782	1.77*	10% level
Primary Occupation	0.92557	9.45***	1% level
Household Size	0.04662	-1.98*	10% level
Social Capital Endowment	0.08314	0.97	Not
Level of Income	0.91981	1.80*	10% level
Monthly Expenditure	-5.30e-07	-0.66	Not
Constant	-0.05236	-0.06	Not
Pseudo R^2	0.7744		
Prob > chi^2	0.0000		
Log likelihood	-12.09596		

Source: Field data 2019

The result in Table 3 above shows the analysis of the level of adoption of risk management Strategy among arable crops farmers in the study area. The result shows that level of education, farming experience, primary occupation, household size and level of income were statistically significant. The level of education was positive and significant at 5% level. This indicates that the higher the level of education attained by the arable crop farmers the more knowledgeable they are and the more willing they will be to adopt strategies that will reduce risk in his business. This agrees with the findings of Njabulo *et.al.,*(2018) that adoption increases with more years of schooling. Thus, a more educated person is expected to appreciate new ideas better and quicker than their counterparts (the less educated farmers). Farming experience and level of income were positive and significant at 10% level. This shows that they have a positive relationship with the level of risk adoption strategy. As farmers experience increases the more he is able to make management strategies that will curb risk so is also as his income increases, the decisions he made will be reflected in his output. This corroborates what Miller et al (2004) said in their work that reduction of risk may result in implicit or explicit reductions in net returns

Primary Occupation also plays a pivotal role in deciding the level of risk adoption strategy to choose. In this study, primary occupation was highly significant at 1% and positive. This indicates that occupation of the respondents also dictate the level of adoption of risk management strategy he should employ. A farmer or trader or civil servant encounters different types of risks and would therefore need to apply different strategies to manage these risks. Household size was negative and significant at 10% level. This indicates that it has a negative relationship with the level of adoption of risk management strategies in the study area. This implies that as household size increases, the ability of the household head to adopt risk management strategies reduces. This may be due to lack of resources for the adoption of these strategies since household expenditure will be high.

CONCLUSION

Farming is risky and farmers live with risk and make decisions every day that affect their farming operations. Through the use of some risk management strategies such as diversification of income sources and diversification of crop enterprise, farmers were able to manage risk to a certain level in the study area. The result of the Tobit regression revealed that farming experiences, educational level, household size, occupation and level of income influenced the likelihood of adoption of risk management strategies among arable crop farmers in the study area. Increase in educational level and farming experience will increase the likelihood of adopting risk management strategies in order to avert risk on the farm.

RECOMMENDATIONS

From the findings of this study the following recommendations are made;

i. Farmers are advised to go to school and acquire knowledge and be more informed about various risk management strategies and how they could be applied on the farm.
ii. Loans should be made available so that arable crop farmers can increase the adoption to risk management strategies.
iii. Farmers should be encouraged to be members of agricultural cooperatives in order to be better informed.

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EFFECTS OF CRUDE OIL SPILLAGE ON FARM INCOME AND LIVELIHOODS OF RURAL FARM HOUSEHOLDS IN BAYELSA STATE, NIGERIA

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ABSTRACT
The ongoing campaign for improved food production depends on rural farmers for its success. One hindrance is the increasing soil infertility due to crude oil spillage caused by the oil and gas sector. This paper examines the effects of crude oil spillage on the livelihoods of rural farm households in Bayelsa State of Nigeria. It identifies and categorized the constraints limiting livelihood options in rural farm households and estimates the determinants of farm income of oil-spilled households in the area. Primary data were collected through a multistage sampling technique to form a total sample size of 60 farm households. The study employed descriptive statistics such as means, percentage, pie-chart, frequency distribution; and inferential statistics such as multiple regression analysis etc. From the findings, many of the respondents had 11-20 years of farming experience. Again, 86% of the households combined farming with other livelihood activities. Furthermore, the statistically significant determinant of farm income in the households were age, household size, farm size, years of farming experience and labour cost. The major constraints to livelihood activities in the area were: inadequate land, poor input supply, financial constraints, high cost of labour, youth restiveness, and poor transport and communication facilities. There should be concerted action by various levels of government to develop policies geared towards making arable land readily available to farmers for agricultural purposes. Public policies on the management of oil pollution must evolve through collaborative arrangement between the government, oil producing companies and the community leaders of the oil producing areas.

***Keywords*:** Food, Production, farmers, oil, spillage, pollution, livelihoods, households, income.

INTRODUCTION
The environmental consequences of oil production activities on the inhabitants of Bayelsa State are reported to be enormous. According to Ukpong et al., (2018), activities of the oil and gas industry influence the natural potentials of the ecosystem and human livelihood. In a Similar view, Odjuvwuederehie *et al* (2006), observed that crude oil exploration and exploitation activities in the Niger Delta have resulted in pollution hazards due to accidental oil spillage, oil pipeline vandalization, gas flaring, and other accidents. Quite often, these hazards reach disaster proportions as witnessed in the 1999 Jesse (Delta State) inferno , which claimed over 1,000 lives; Oviri Court and Evwreni (Delta State) fires in 2000, and the Isuikwuato (Abia State) fire in June 2003, which was responsible for the death of more than 150 lives (United Nations Development Programme, (UNDP), 2014). Oil production activities have degraded most agricultural lands in the State and have turned hitherto productive areas into wastelands. With increasing soil infertility due to the destruction of soil micro-organisms, and dwindling agricultural productivity, farmers have been forced to abandon their farmlands to seek non-existent alternative means of livelihood. Aquatic lives have also been destroyed with the pollution of traditional fishing grounds, exacerbating hunger and poverty in the fishing communities. Crude oil exploration and export

from the Niger Delta earns over $20.5 billion yearly and provides more than 90% of the country's foreign income earnings and providing over 70% of the federal budget.Exploration for crude oil in Nigeria began in 1908 but the first serious discovery was not made until 1956 onshore in Oloibiri in Bayelsa State by Shell D' Arcy (now Shell Petroleum), an Anglo Dutch oil company (Agbola & Alabi, 2003). Commercial shipments began two years later but were on a modest scale until the mid 1960, when off shore production began. According to Jike (2004), the expectations surrounding the discovery and exploration of oil has waned over time due to the state of affairs in the Niger Delta region. Bayelsa State, as in other states of the Niger Delta region is a development paradox characterized by endemic poverty in the midst of abundant natural resources (Anejionu et al., 2015).

Among the key crude oil induced pollution in Bayelsa State include oil spillage, gas flaring, and pipeline explosions. It is observed that Over 10,000 oil spills and pipeline explosion incidence have been recorded and more than 350 billion cubic metres of gas have been flared in the Niger Delta region in the last 14 years. These have caused huge human and material losses in addition to environmental degradation and poor air quality. The region′s ecosystem has therefore been declared one of the most endangered ecosystems in the world (Anejionu*et al.,* 2015). Considering the foregoing therefore, appropriate development targets of Nigeria, especially in the Niger Delta (including Bayelsa State) would be considerably dependent on rural development within the context of sustainable livelihoods. A livelihood is sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Scoones, 1998).

According to Omofonwan and Odia (2009), the rural poor need to have greater access to variety of assets such as human, infrastructural, technological and financial- if they are to take control of their lives. They need to have influence over the major decisions affecting their well-being, including those taken by local and national governments. They also need to be less vulnerable to external shocks that threaten their already weak asset base (such as incessant oil spillage, natural disaster and conflict). The broad objective of the study was to examine livelihoods and poverty status among rural arable crop farm households in oil-spilled and non-oil spilled areas of Bayelsa State of Nigeria. The specific objectives were to: examine the socio-economic characteristics of rural farm households in Bayelsa State; analyze the livelihood activities engaged in by rural farm households in the area; estimate the determinants of farm income of oil-spilled farm households in the study area and identify and categorize the constraints limiting livelihood activities of rural farm households.

Conceptual Framework

The concept of livelihood has become increasingly popular in development thinking as a way of conceptualizing the economic stream of activities which poor people undertake in their totalities (Adato & Meinzen-Dick, 2003). The focus of development thinking in the 1970s on employment and jobs has given way to the realization that while job creation in the formal sector continues to be one important strategy for poverty reduction, the real belief of people in the south is that survival and prosperity depend on the pursuit of diverse and multiple activities simultaneously, by different members, taking advantage of different opportunities and resources at various times; They maintain a portfolio of activities by seeking and finding different sources of food, fuel, animal fodder, cash and support in different ways in different places at different times of the year (Hanghton, 1994).The term livelihood is therefore defined as the activities, assets and access that jointly determine the living gained by an individual or household. Due to economic pressure, increasing risks associated with agriculture as a result of climate change and the inability of many

farm households to meet basic needs such as foods, clothes, and housing, some household members often search for alternative means of livelihood (Ellis, 1999). According to Olawole (2002), livelihood reveals how rural dwellers meet their needs through the variety of activities engaged in to secure the goods and services required by the household. Livelihood systems diversify to account for variation in the nature and intensity of vulnerability, depending on different ways in which people acquire access to food (International Fund for Agricultural Development, IFAD, 2001). Kuye (2004) noted that rural dwellers obtain their livelihoods with varying degrees of success according to their access to resources and employment and how they deal with pressures arising from social, economic, and environmental changes. In Niger- Delta, households derive their livelihoods in a variety of ways including different types of crop farming, livestock rearing, fishing, trading, hunting, gathering of forest products, working as hired labourers, tailoring, hair dressing, and craft making. In a recent study covering the six geo-political zones of Nigeria, it was found that the overall average activities per person, whether male or female was 3.5 (Olawole, 2002). There were variations by locality, but in all areas, people engaged in more than one activity to 'make a living' (Olawoye, 2002).

Oil spillage occurs when exploration and exploitation and marketing damage to oil pipelines and accidents involving road trucks and tankers release various toxic materials such as phenol cyanide, sulphide-suspended solids, barites, bentonite clay, chromium and biological oxygen demanding organic matter into the environment which adversely affect soil, plant, animal and water resources (Chukuezi, 2006). Explosions from seismic surveys, dredging canals and contamination of rivers and creeks are among the grievous ecological violence of oil production in Nigeria. Contaminants such as drill cuttings and drill mud are known to disrupt the natural ecological balance when released into the soil (Worgu, 2000).

Egberongbe*et al* (2006) grouped oil spills into four major categories namely: minor, medium, major and disastrous. Minor oil spills involve the discharge of any amount of oil that is less than 25 barrels in inland waters or less than 250 barrels on land without threat to public health and welfare. Medium and major oil spills involve the discharge of 250 – 2500 barrels on land, offshore or coastal waters. Disastrous oil spill, the most extreme form, is described as uncontrolled oil- well blow-out, pipeline rupture or storage tank failure, which poses imminent threat to the public or welfare. According to Ntukekpo (1996 cited in Egberongbe et al, 2006) many communities in the Niger Delta have experienced several incidents of disastrous oil spills since the inception of oil exploration on a commercial scale in the region.

METHODOLOGY

This study was conducted in Bayelsa State which is a major oil and gas producing area and contributes over 30% of Nigeria's oil production. In the State, oil spillage is one of the greatest intractable environmental problems caused by crude oil exploration (Odjuvwuederhie; *et al* 2006). Oil spills have degraded most agricultural lands in the State and turned hitherto productive areas into infertile lands (Joel, 2008). The State has three agricultural zones namely: Yenagoa, Ogbia-Brass, and Sagbama.

A multistage sampling technique was employed to draw samples for the study. In the first stage, two Local Government Areas from each of the three agricultural zones of the State were purposively selected based on the level of oil exploration and production activities in the area. This gave a total of six L.G.As. The second stage involved simple random selection of two communities each from the six Local Government Areas to give a total of 12 communities. In each of these 12 communities, the village head was contacted for a list of five farm households which have suffered from oil spillage in the last five years.

Data were collected on socio economic characteristics such as age, education level, household size, farm income, incidence of oil spills, farm size, farming experience, capital assets, labour use, household income, household expenditure, livelihood constraints and other farm operations.

Descriptive statistics like means, percentage and frequency distribution were used to achieve objectives: i, ii, and iv while Objective iii was estimated using multiple regression function; the determinants of farm income of rural households in oil-spilled farm households, the multiple regression function was estimated implicitly as:

F_{Ai}= F(Ag, Hs, Le, Fs, Ye, Se, Lc, Ac, Is, D) 1

where,
F_{Ai} =Total annual farm income of household heads (measured as output of crops in Naira),
Ag = Age of household head (years)
Hs= Household size (number of individuals per household)
Le = Level of education (years spent in school)
Fs= Farm size of respondents (Hectares)
Ye = Years of experience in farming
Se = Sex of household head measured as dummy (male = 0, female = 1)
Lc = Labour cost in all farm operations (Naira)
Ac = Access to credit (measured as amount of credit received in the last one year)
Is = Income sources (total number of economic activities per household), and
D = Dummy variable representing household type
(D: 1=oil-spilled farm households; 0 =non-oil spilled farm households)

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the farmers

Household size

The distribution of the respondent farmers based on their household size is presented in Table 1.

Table 1: Distribution of respondents based on household size

Household size of oil-spilled households Size	Frequency	Percentage
1-5	29	48.3
6-10	28	46.7
11-15	2	3.3
16-20	1	1.7
Total	60	100
Mean	5.68 (3.24)	

Source**:** Computed from survey data, 2019; ( ) = standard deviation

The table reveals that 46.4 percent of oil spilled farm households had household sizes of between 6-10 persons.

The mean household size for the spilled households is 7 persons per household. This figure is relatively high. Though a very large family size may constitute a social burden, larger families use their labour input to an advantage in farming. In fact, the intensity of agricultural production has been found to have a direct relationship with household size (Adhikari, 2002).

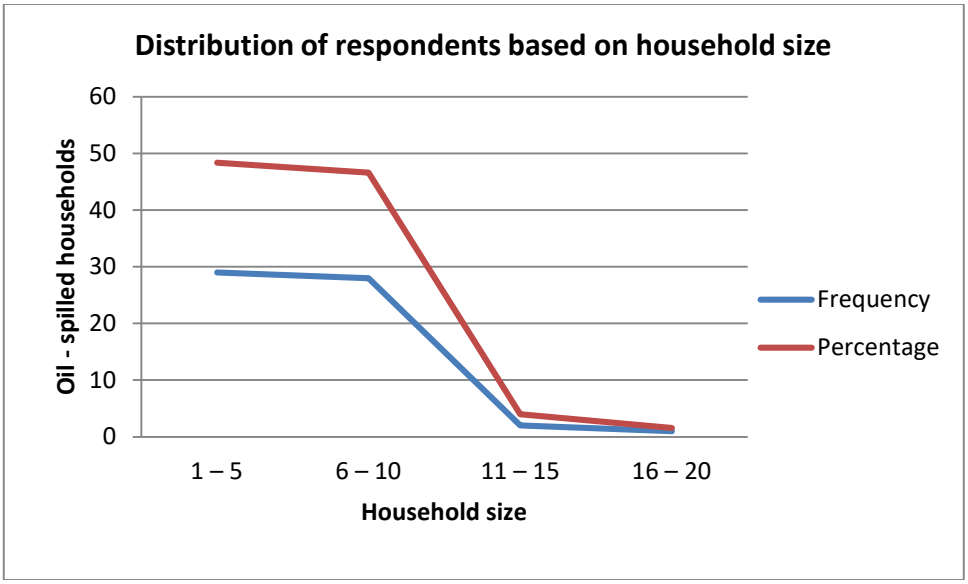

Figure 1: Distribution of respondents based on household size

Education

The frequency distribution of the respondents according to years of formal education is presented in Table 2 as shown below:

Table 2: Distribution of respondents based on level of formal education

Education level	Oil - spilled households	
Variable	Frequency	Percentage
Tertiary	15	21.6
Secondary	11	18.4
Primary	21	35.0
No education	13	21.6
Total	60	100

Source: Computed from survey data, 2019

A minor proportion of the crop farmers households that experienced oil spillage had primary education (35%) while 21.6 percent had no formal education. On the whole, about 79.4 percent of the oil-spilled households had some form of formal education, an observation which tends to refute the alarming rate of illiteracy prevalent in rural communities of Niger Delta area of Nigeria. According to Okejie (2002), increase in educational level of investors lead to a corresponding increase in the standard of living of farm households. In a study of determinants and uses of farm income from the cassava enterprise in Ondo State, Nigeria; Mafimisebi (2008) found that 47 percent of the farmers had secondary education. This result is in line with the views of Oladimu and Fabiyi (1984); that respondents with sustained level of formal education better appreciate improved methods of technologies. Formal education according to Amaechi (2007) enhances the producers' managerial ability of record keeping, rational decision taking, cost reduction and maximization of opportunities. Thus, education will predispose farmers to be innovative and put them in a better position to cope with the intricacies of new factors and product makets that the adoption of new technologies introduces them to.

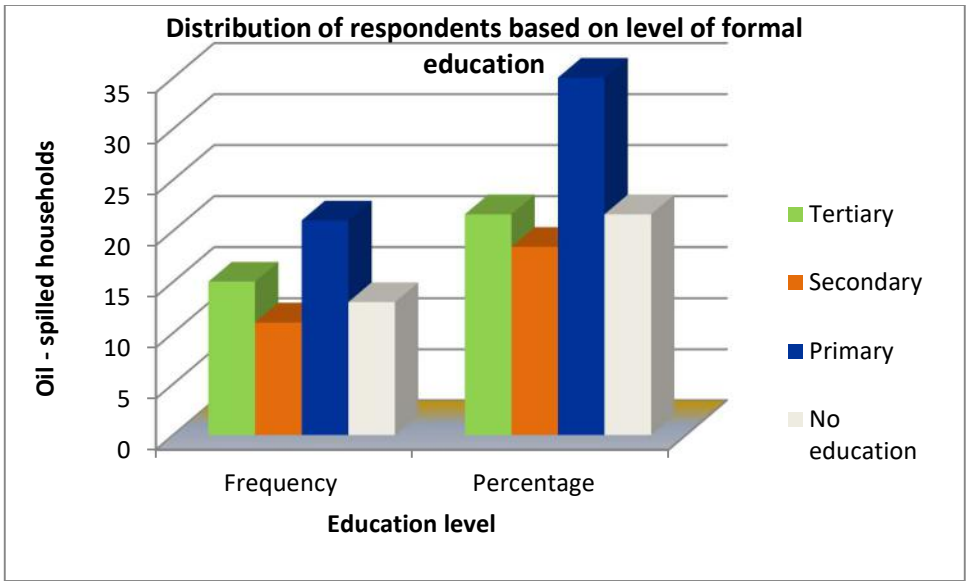

Figure 2: Distribution of respondents based on level of formal education

Distribution of respondents based on years of farming experience

Table 3 below shows the distribution of respondents according to years of farming experience in arable crop farming

Table 3: Distribution of respondents based on years of farming experience

Years of experience of Oil-spilled households		
Years	Frequency	Percentage
1-10	23	38.3
11- 20	28	46.7
21-30	4	6.7
31-40	3	5.0
41-50	2	3.3
Total	60	100
Mean	14.33	(7.92)

Source: Computed survey data, 2019. Figures in parenthesis = standard deviation

Results from Table 3 shows that 46 percent of the oil-spilled households have been farming for more than 19 years. About 46 percent of the rural farmers had between 11-20 years of farming experience. Onyebinama (2004) observed that previous experience in farm business will enable the farmer to set realistic cost and time target, allocate and utilize resources efficiently and identify production risk.

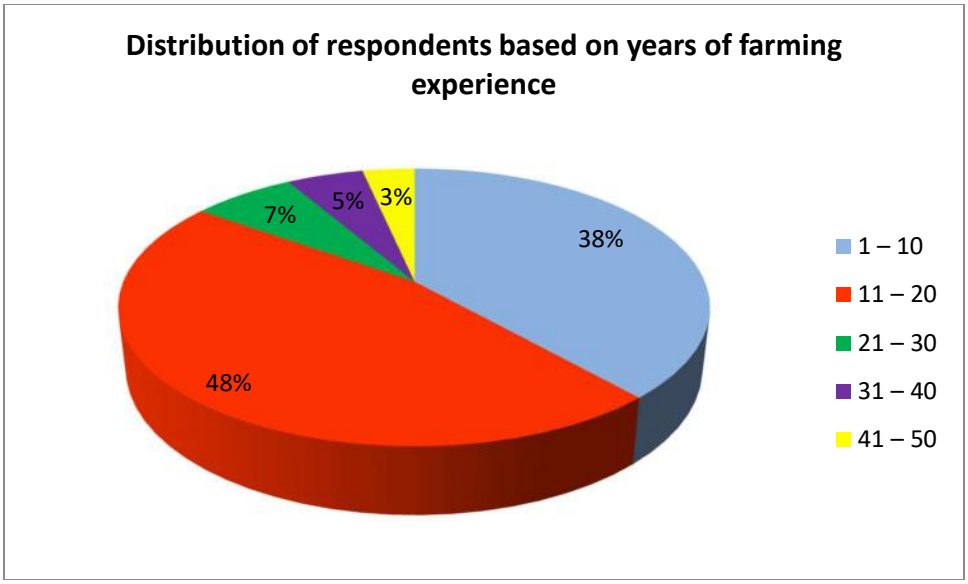

Figure 3: Distribution of respondents based on years of farming experience

Distribution of respondents based on type of occupation:

Table 4 shows the distribution of the farmers based on their primary and secondary occupations:

Table 4: Distribution of respondents based on type of occupation

Occupation	Oil-spilled households	
	Frequency	Percentage
Full time farming	8	13.3
Farming and Trading	9	15.0
Farming and Fishing	11	18.3
Farming and Craft work	4	6.7
Farming and Civil service	18	30
Farming and Others	10	16. 7
Total	60	100

Source: Computed from survey data, 2019

It reveals that about 13.3 percent of the oil-spilled households engaged in full time farming while 86.7 percent combine farming with fishing, trading, civil service, crafting and other livelihood options. Though the trend is expected, it is only surprising to see this unusual low number of households engaged in full time farming. This finding compared favorably with those of Ihejiamaizu (1999); Odjuvwuederhie (2006); and Chukuezi (2006). For instance, Ihejiamaizu(1999) explained that oil production activities have degraded most agricultural lands in the state and have turned hitherto productive areas into waste land.

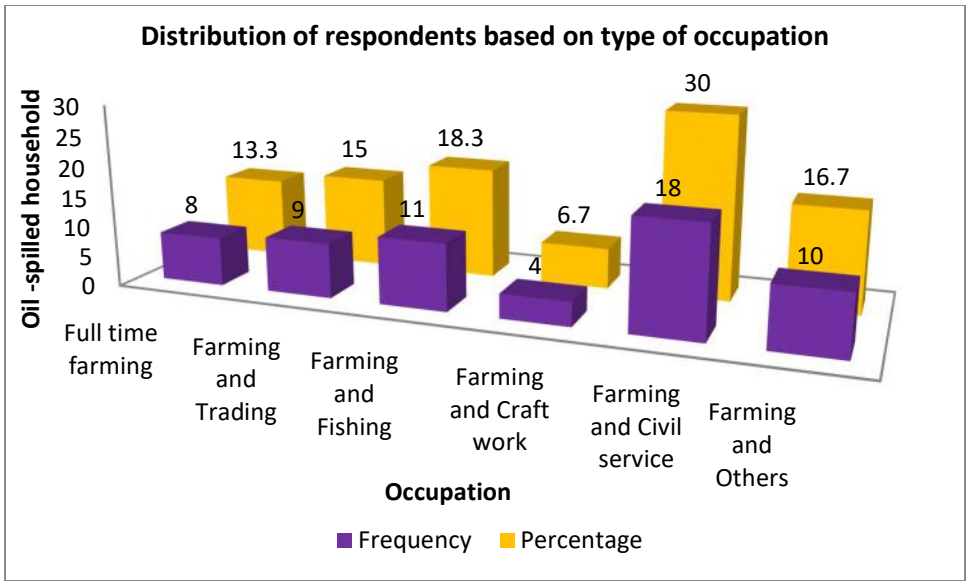

Figure 4: Distribution of respondents based on type of occupation

Determinants of farm income for oil-spilled farm households

Results of determinants of farm income for oil-spilled households are presented in table 5 below:

Table 5: Determinants of farm income of oil-spilled farm households

Variable	Double-log	Exponential	Semi-log	Linear
Constant	7.982	10.246	-86645.09	20296.53
	(5.86)***	(23.12)***	(-1.67)	(1.17)
Age	0.869	0.012	40684.27	585.20
	(2.21)**	(1.21)	(2.72)**	(1.58)
Household size	-0.896	-0.168	-30 694.8	-5213.28
	(-4.99)***	(-5.08)***	(-4.49)***	(-4.04)***
Education	0.308	0.006	666.01	172.73
	(0.38)	(1.69)*	(-0.22)	(1.15)
Farm size	0.312	0.128	12689.62	5777.88
	(2.57)**	(2.01)	(2.75)***	(2.32)**
Farming experience	0.242	0.007	2822.24	480.12
	(2.10)**	(0.81)	(0.64)	(1.43)
Labour cost	0.071	0.002	2210.78	5.000
	(3.71)***	(3.00)***	(3.06)***	(2.07)*
Sex	-0.094	-0.027	-4900.54	-3446.82
	(-0.71)	(-0.20)	(-0.97)	(-0.65)
Credit	0.083	0.126	699.73	903.88
	(0.50)	(0.72)	(0.11)	(0.13)
Income sources	-0.073	-0.055	-2963.66	-2336.52)
	(-0.36)	(-0.53)	(0.38)	(1.17)
R^2	0.576	0.533	0.559	0.487
R^-	0.501	0.447	0.480	0.394
F-Ratio	7.57***	6.33***	7.05***	5.27***

Source: Computed from field survey data, 2019

Note: (.) = t-statistic computed; ***, **, * = statistically significant at 1, 5 and 10 percent respectively.

The regression results shown in Table 5 indicates that age, household size, farm size, years of farming experience and labour cost were the only significant determinants of farm income for oil-spilled households, while household size had a significantly negative effect (at 5% levels of significance) on the farm income of the households. This implies that larger households are more likely to have reduced income, which is consistent with economic theory. Ukoha (2007) observed that the larger the household size the more difficult it may be for the households to meet their basic requirements such as education for children; proper nutrition and adequate housing, all of which tend to reinforce poverty. Although, larger families use their labour input to an advantage in farming, a very large family size may constitute a social burden. This is because farmers with large households tend to dissipate most of their resources on upbringing and education of their children. Farm size had a coefficient that conformed to *a priori* expectations, positive and significant in the households at 1% levels of significance. The interpretation is that increase in the farm income of households leads to a corresponding increase in farm size of arable crop farmers in Bayelsa State. One reason is likely to underpin this: since output level is directly related to land area under cultivation, an increase in farm output would therefore cause farm income to rise with subsequent reduction in poverty level. Several other empirical studies including Onyebinama and Onyejelem (2010) observed that output is likely to increase as farm size increased.

CONCLUSION

The impact of oil spill on the degradation of the environment of the Niger Delta region of Nigeria has raised questions of great concern to stakeholders, particularly oil producing communities who have suffered polluted air and water resources, degraded forests and farm land, and very high atmospheric temperatures for over 35 years. The study established that environmental degradation of the oil-rich State was wanton and continuous with dire health and socio-economic consequences for its people. The study revealed that oil spill was a major threat to crop production in Bayelsa State.

RECOMMENDATIONS

The following recommendations were made:

1. Since economic compensation and inducements cannot serve as panacea for prevention and preservation, government should compel the oil multinationals to adhere to standard operational procedures for oil exploration and exploitation.
2. Modern technologies of extraction should be adopted by these companies to reduce the negative impacts of their activities on the environment and the people.
3. The policy on replacement of ageing pipelines should also be pursued vigorously. This will halt the continual degradation of the Niger Delta environment, and regulate the environmental consequences of oil spillage, as well as guarantee the people a better livelihood.

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PROFIT EFFICIENCY AMONG ENERGY CROPS FARMERS IN EDO STATE NIGERIA

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ABSTRACT
The importance of energy crops production to achieve Biofuel technology which can augment the energy gap in Nigeria cannot be over emphasised. This study examined the profit efficiency in Biofuel crop production among farmers with a view to isolating significant factors leading to variation in farm specific profit inefficiencies among the farmers in Edo State, Nigeria. Cross section data obtained from 315 representative samples of Biofuel crop farmers with aid of structured questionnaire, assisted with personal interview were analysed by the use of descriptive statistics to explain the socio-economic characteristics of the farmers and stochastic frontier profit function to estimate profit efficiency of the energy crops farmers. Results showed that about 77.5% of farmers attended secondary school education and about 70.1% had between 6-15 years farming experience with mean farm size of 2.12 hectare, mean age of farmers was 50 years and about 60.6% of the farmers were male respectively. The result further showed that the analysis of the profit efficiency of farmers ranged between 0.32 and 0.99 with a mean value level of 0.78 which indicated an efficiency gap and that an estimated 22% is loss in profit due to a combination of both technical and allocative inefficiencies. The study further shown that age of farmers and farming experience were the main significant factors that influenced profit efficiency positively. The study concluded that there is scope for increasing profit efficiency in Biofuel crops production by directing policy option on these profit efficiency factors in the study area.

Key words: Profit efficiency, Biofuel crop farmers, Edo State

INTRODUCTION
Increasing per capital food production and raising the rural life standard have become the greatest challenge facing Nigeria in recent times. About 80 percent of Nigeria rural population depend on agriculture for livelihood and most of them are classified as smallholder farmers who grow basic biofuel crops like maize, cassava, rice, wheat and jatropha, which play essential role in their economic life, infringe directly on the food security and income for the rural households. For instance, the "Presidential initiative on cassava production in Nigeria" was inaugurated in 2005 with the aim of achieving an annual basis of five billion dollar from only export of cassava. Cassava could also be used in the production of ethanol which can be used to complement petroleum. Thus, with biofuel crops production capacity need to be increased for farmers such that rising demand will be met. One of the ways by which this can be achieved is to improve the profit accruing to these farmers through their personal effort in production. The combustion of fossil fuels such as petroleum oil, coal and natural gas generate power that releases poisonous substance into the air. Energy gotten from these gases power almost two-third of our present electricity use for all transportation with associated problems created when they are burnt to create energy. Chief among these by-products are carbon dioxide (CO2), nitrous oxide (NO2),which are greenhouse gases and are major contributors to global warming and also harming our environment today.

According to the United State Department of Energy, (2009) emphasis that reduction in fossil fuel energy usage would cut down annual greenhouse gases by 1.1 gigatons which is equivalent to taking their entire united states fleet of vehicles small trucks off road. In addition, the hazards in burning of fossil fuel can cause health problems to humans; Nitrogen oxides causes irritation

to the lungs and cardiac problems. Union of Concerned Scientist (2005). The use of Biofuel in Nigeria is anticipated to make significant impact on the petroleum products consumption, additionally tax revenue of government from economic authorities attributable to the industry, job creation, reduction in agriculture output wastage. The Federal Government of Nigeria did recognise the importance of bio-fuel technology decided to pursue policies to promote its production recently by establishing energy centres to address energy issues such as energy research and development centre for energy research and training in some federal universities and created an energy commission. According to Jarmo (2004) corn ethanol account for the highest share of bio-fuel produced in the United States. Cellulosic ethanol reduces agricultural waste, sugar cane ethanol produce much energy, cassava ethanol and jatropha oil are use as fuel for lamps, cooking stoves, Jatropha seeds when processed into bio-fuel will provide job opportunity so that there will more than enough petroleum for export and other local uses, these can be replicated in Nigeria given an efficient production of energy crops.

Farell (1957) in his pioneering study defined efficiency asthe ability to produce a given level of output at lowestcost. Efficiency can be analyzed by its two components technical and allocative efficiency. Technical efficiency isthe degree to which a farmer produces themaximum feasible output from a given bundle of inputs(an output oriented measure), or uses the minimumfeasible of inputs to produce a given level of output (aninput oriented measure). On the other hand, allocativeefficiency relates to the degree to which a farmer utilizesinputs in optimal proportions, given the observed inputprices. These components have been measured by the use of frontier production function whichcan be deterministic or stochastic. Deterministic frontier production function explains that all deviations from thefrontier are attributed to inefficiency whereas instochastic frontier production function it is possible todiscriminate between random errors and differences inefficiency. Yotopoulos *et al*. (1970) argued that a production function approach to measure efficiency may not be appropriate when farmers face different prices and have different factor endowments. Thus, this led to the application of stochastic profit function models to estimate farm specific efficiency directly (Ali *et al*., 1994; Wang *et al*., 1996; Ogundari, 2006). According to Ali *et al*. (1994) the profit function approach combines the concepts of technical and allocative efficiency in the profit relationship and any error in the production decision is assumed to be translated into lower profits or revenue for the producer. Profit efficiency is the ability of a farm to achieve highest possible profit given the prices and levels of fixed factors of that farm and profit inefficiency is loss of profit from not operating on the frontier (Ali and Flinn, 1989).

However, Battese and Coelli (1995) had extended the stochastic production frontier model by suggesting that the inefficiency effects can be expressed as a linear function of explanatory variables, reflecting farm-specific characteristics. The advantage of their model is that it allows estimation of the farm-specific efficiency scores and the factors explaining efficiency differentials among farmers in a single stage estimation procedure. This study therefore, used Battese and Coelli (1995) model by postulating a profit function, which is assumed to behave in a manner consistence with theStochastic frontier concept. The model is applied to this study.

The stochastic frontier profit function is defined as:

$$\pi_i = f(p_{ij}., Z_{ik}, D_{ij}) \quad \text{Exp } e_j \text{----------(1)}$$

Where:

π_i is normalized profit of the ith farm and it is computed as gross revenue less variable cost divided by farm-specific cassava price; Pij is the price of the ith variable input faced by the jth farm divided by cassava price; Zik is level of the kth fixed factor on the jth farm; Dij are the dummy variables for the jth farm (D= 1 and 0 otherwise); ej is an error term which is

assumed to behave in a manner consistent with the frontier concept (Ali and Flinn, 1989), that is

$e_j = V_i - U_i$----------(2)

and i = 1, ... N, is the number of farms in thesample.

From Equation (2), Vis are assumed to be independently and identically distribution N (0, a2) two sided random errors, independent of the Uis; and the Uis are non-negative random variables, associated with inefficiency in production, which are assumed to be independently distributed as truncations at zero of thenormal distribution with mean, $\mu i = \delta_0 + \sum_d \delta_d w_{di}$ and variance $\sigma\mu 2(I\ N(\mu, \sigma\mu^2 I)$, where Wdi is the d^{th} explanatory variable associated with inefficiencies on farm i and δ_0 and δ_d are unknown parameters [Rahman, 2003].

The profit efficiency of farm i in the context of the stochastic frontier profit function is defined as

$$PE_i = E[\exp(-\mu_i) \mid e_i] = E\left[\exp\left(-\delta_0 - \sum_{d=1}^{D} \delta_d W_{di}\right) \mid e_i\right]$$

----------(3)

PEj lies between 0 and 1, and it is inversely related to the level of profit inefficiency. E is the expectation operator. This is achieved by obtaining the expectation jo, upon the observed value of ei. The method of maximum likelihood was used to estimate the unknown parameters, with the stochastic frontier and the inefficiency effects functions estimated simultaneously. The likelihood function is expressed in term of the variance parameter

δ_μ^2 and $\gamma = \delta_\mu^2 / \delta^2$(Battese and Coelli, 1995).

METHODOLOGY

The study was conducted in Edo State Nigeria. The state has a total land area of 17,802km$_2$ and population of 3,218,332 people (2006 census) and is located on latitude 5^0 04' and 34' North of the Equator with longitude 5^0 04' and 6^0 44' East of the green wish meridian. It is made up of three senatorial districts with Edo South, Central and North senatorial districts with 7, 6 and 5 local government areas (LGA) respectively giving a total of 18 (LGA). The state has a typical climate with thick vegetation cover, high rainfall, relative humidity of about 70% and adequate sunshine which favour the growing of crops like maize, cassava, yam, Jatropha in most agricultural communities. Farming is a major occupation in the rural areas. The data used for this study were essentially from primary source which were obtained from 315 representative biofuel crop farmers through simple random sampling spread across the state. Data were collected with the aid of structured questionnaire administered on the farmers coupled with personal interview. The questionnaire was design to capture type of biofuel crops, yield, unit cost of labour, per man day, farm size, input price, price for Agro-chemicals and farm tools and equipment. Information on socio-economic variables such as year of education, gender, age, marital status, farming experience of the farmers were also collected.

Descriptive statistics was used to examine the socioeconomic characteristics of farmers in the study area, while stochastic frontier profit function specified in equation (1) was used to analyze profit efficiency of the biofuel crop farmers. Four biofuel crops were identified in the study area (cassava, maize, sugar cane and Jatropha). Data were collected on output of farmers; price were used to compute farm total revenue as PxQ

Where,

P is the price of the output

Q is the output of farmers while the farm level profit was computed as difference between the total revenue and total variable cost expected on producing the crops. gross marginal (GM) = TR – TVC

The explicit Cobb-Douglas function form of the stochastic frontier profit function in equation (1) for the biofuel crops farmers in the study area was there for specified as follows:

$л_i = b_0 + b_1 lnX_1 + b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_4$ ---------- $b_6 lnX_6 + V_i - U_i$ ---------- (4)

where,
$л_{i\ is}$ normalised profit (GM)
x = average cost of fertilizer in naira
x_2 = average cost of labour per man/day in naira
x_3 = average cost of planting material in naira
x_4 = average cost of agrochemicals in naira
x_5 = average depreciation of farm tools and
x_6 = average cost on rent on farmland
b = parameters to be estimated
V_i = statistical disturbance term
U_i = farmers specific characteristics related to profit in efficiency
The profit inefficiency model (Ui) is defined by
$Ui = \delta_0 + \delta_1 z_1 + \delta_2 z_2 + \delta_3 z_3 + \delta_4 z_4 + \delta_5 z_5$ ---------- (5)
Z_1 = age of farmers gender
Z_2 = gender of farmers
Z_3 = farming experience
Z_4 = educational status of farmers
Z_5 = nature of farming (fulltime or part time)

The maximum likelihood estimates of the parameters of the stochastic frontier profit function and the inefficiency model defines by (4) and (5) were simultaneously obtained using FRONTIER 4.1 (Coelli, 1996).

RESULTS AND DISCUSSION

Socioeconomic characteristics of farmers

Table 1.0: Socioeconomic Characteristic of Respondents

Variables	Frequency	Percentage	Mean
Gender			
Male	191	60.6	
Female	124	39.4	
Age			
21-30	1	0.3	
31-40	29	9.2	
41-50	142	54.1	50
51-60	108	34.3	
>60	35	11.1	
Farm size			
0.01 – 1.00	108	34.3	
1.01 – 2.00	99	31.4	
2.01 -3.00	55	17.5	2.12
3.01 and above	53	16.8	
Farming experience			
1-5	48	15.2	

6-10	116	36.8
11-15	105	33.3
16-20	41	13.0
>20	5	1.6
Educational status		
No formal	6	1.9
Primary	65	20.6
Secondary	170	54.0
Tertiary	74	23.0
Types of bio-fuel crops …		
Jatropha	10	3.07
Cassava	302	92.64
Maize	245	75.15
Hedges	65	19.94

Source: Survey data analysis, 2020

Note that frequencies and percentages as applied in this variable are not additive.

The socioeconomic characteristics of farmers examined include gender, age, farm size, farming experience, educational status and type of Biofuel crop grown. The results are presented in Table 1 above. The results indicated that majority (60.6%) of the bio-fuel crops farmers were male, while about (71.0%) of the farmers were having farming experience of between 6-15 years. This finding corroborates with Oladeebo and Oluwaranti (2012) who had asserted that the more experience and age farmers has the higher proficient in the methods of producing optimal allocation of resources is expected and the lower profit inefficiency. Most of the farmers (65.7%9 had farm size of between 0.1 hectare – 2.0 hectare indicating small scale nature of farming in the study area. About 77.0% of the farmers had between secondary and tertiary education, indicating that the quality of labour is improved and with its propensity to accept new technologies which would improve their level of profit (Hyuha, 2006; Egbodion and Emokaro, 2012). Out of the biofuel crops grown in the study area 3.01% grow Jatropha, 92.64% were growing cassava, 75.15% grow maize while 19.94% were growing hedges, indicating that most of these farmers were into cassava production. This may be attributed to the initiative of government towards cassava production and the high demand associated to cassava products usage by both man and livestock.

Profit efficiency estimates

Table 2: Maximum likelihood estimates of the stochastic profit frontier function for bio-fuel crop production in Edo State, Nigeria

Variables	Coefficient	Standard error
Constant	0.8186	1.7175
Average price per man-day of labour (p_1)	0.4868***	0.0514
Average price of fertilizer (kg) P_2	0.2527***	0.0769
Average price of flaunting material (kg) P_3	0.0941	0.0859
Average price of agrochemicals (p_4)	0.3068	0.2602
Average depreciation of farm tools (p_5)	0.5099***	0.1573
Average price for rent on land (p_6)	-0.2492	-0.1572
Inefficiency model		
Constant	-0.7261	1.2185
Age of farmer	0.0087**	0.0036
Gender	-76.4506	758.4387
Farming experience	0.0253**	0.0098
Educational status	0.0458	0.553

Nature of farming	-0.5385	0.4903
Sigma square	1.0542***	
Gamma	0.0511	
Loglikelihood ratio	-441.6	
Chi square	13.689	

Source: field survey data analyse 2020** @ 5% ***@1%

Table 3.0: Distribution of profit efficiency indices among the biofuel crop farmers in the study area

Efficiency index	Frequency	Percentage
0.21 – 0.40	5	1.59
0.41 – 0.60	71	22.54
0.61 – 0.80	156	49.52
0.81 – 1.00	83	26.35
Maximum score	0.99	
Minimum score	0.32	
Mean score	0.78	

Source: survey data analysis, 2020

The MLE estimates of equation (4) are presented in Table 2.0 and with assumption that the coefficients of the estimated parameters of the normalized profit function is based on pure market competition of inputs and outputs and were positive except the cost for rent on farm land but this is expected. This implied that a unit increase in the prices of inputs with positive coefficient will lead to increase in the normalized profit of biofuel crops produced and vice versa. However, the coefficients of labour, fertilizer and depreciation were positive and statistically significant at 10 percent, indicating that these variables determine profit efficiency of farmers in biofuel crop production in the study area. In addition, the estimated sigma square was (1.052) positive and statistically significant at 10 percent, indicting a goodness of fit of the model. The estimated gamma value (0.0511) was positive, indicating that about 5.11 percent of the variation in profit among the farmers were due to difference in farmers practices rather than random variability.

The result presented at the lower end of Table 2.0 shown the estimates of the inefficiency model for this analysis, the signs and significance of the estimated coefficients in this model have important implication on the profit efficiency of farmers in the study area. Consequently, gender and nature of farming were negative in the model but not significant and that these variables slightly increased the profit efficiency of farmers while the coefficient with positive sign indicated that as these variable increases, the profit inefficiency of famers increased, however this result do not support expectation that educational status of farmers could have indirect implication on the efficiency of farmers. The decile range of profit efficiency of farmers and distribution are presented in Table 3.0. The profit efficiency score ranges from 0.32 to 0.99 with an average score of 0.78, indicating an efficiency gap and that an average farmer in the study area could increase profit by about 22% to improve on his technical and allocative efficiency in biofuel crop production in the study area. This result support the findings of Rahman (2003) and Oladeebo and Ohuwaranti (2012) who reported mean profit efficiency level of 0.77 and 0.79 for Bangladeshi rice farmers and cassava farmers in Oyo state respectively. It is observed that from this distribution that despite the variation in efficiency score about 75.88% of the farmers had efficiency score of 0.61 and above while the worse of these farmers had profit efficiency score of 0.21, indicating that a considerable amount of profit could be obtain by improving on the technical and allocative efficiencies of these farmers in the study area.

CONCLUSION

The study found out from results of estimated data that biofuel crops production in the study area is based on the availability of some basic inputs to farmers such as hired labour, fertilizer and farm tools and equipment 'It was concluded by inferring from the results obtained from the inefficiency model that, there is scope for raising efficiency for biofuel crops production in the study area.

RECOMMENDATIONS

Policy options should be directed on these factors that reduce farmers efficiency in the study area.

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DETERMINANTS OF VEGETABLE PRODUCTION IN EDO STATE, NIGERIA: A STOCHASTIC FRONTIER APPROACH

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ABSTRACT
Recent studies have shown that low output of vegetables and poor technical know-how are the problems being encountered by the smallholder farmers in Greenleaf vegetable production and that vegetables are sources of protein for daily food requirement for about 200 million Nigerians. The study examined technical efficiency of Greenleaf vegetable (Amaranthus cruentus) production with a view to ascertaining the determinants of vegetable production in Edo state. A total of 82 farmers were sampled with purposive and simple random sampling, with the aid of a structured questionnaire assisted with personal interview. Data were analyzed with descriptive statistics (mean scores, percentage, frequency count), and stochastic frontier production function through a maximum likelihood estimation procedure. The results indicated that the mean age of farmer in the study area was 49 years, with farming experience of 13 years. Most of the farmers were females (58.5%) with a mean household size of 5 persons and farm size of 1.0 hectare respectively. The stochastic frontier production function estimate showed sigma value of 0.29 which was positive, indicating a goodness of fit and a gamma value of 0.44. Farm size and labour were the positive and significant variables in the production process, with RTS of 0.277, indicating an increasing-decreasing return to scale. The mean efficiency value was 0.58 which implied that the farmers were operating 42% below the frontier, indicating an efficiency gap. The result showed that age, sex and marital status determine the farmer's efficiency. It was concluded that the business is profitable and that there was wide inefficiency among the farmers. It is recommended that grants and training programs should be made accessible to farmers and formulation of enabling policies to favor female farmers in the production process.
Keyword: Vegetable production, Edo State, Stochastic Frontier

INTRODUCTION
Agricultural production in Nigeria is dominated by small-scale farmers who produce more than 90 percent of the food consumed in the country. One of the major crops produced are vegetables which represent an essential part of agricultural products. Their production remains entrenched in Nigerian agriculture and forms an important condiment in the national diet (Ibekwe and Adesope 2010). Vegetables are rich and comparatively cheaper source of protein, vitamins, carbohydrates and minerals. They are also described as herbaceous plants whose part or parts are eaten as supporting food or main dishes which may be aromatic, bitter or tasteless. Nigeria is endowed with varieties of Vegetables and different types are consumed by various ethnic groups for different reasons. Vegetables are the most important and extensively cultivated food and income generating crops in many parts of Africa (Adebisi-Adelani, Adeoye, 2011). Greenleaf (*Amaranthus Cruentus*) popularly known as African spinach is an herbaceous leafy vegetable grown in Nigeria, the vegetable is unique among all vegetables in terms of short duration of maturity, profitability and it can easily be cultivated on small areas (Oluijide & Oladele, 2007).
In Nigeria Greenleaf vegetables is widely grown as subsistence in level landswhich offers a significant opportunity for poor households to generate income through commercial production of the vegetable with relatively minimal labour requirement in the various farm operations (Emokoro, Ekwunwe & Osifo, 2007). Vegetable support rural and urban populations in terms of subsistence

and income generation without requiring huge investments (Department for International Development and Research for Development, 2010). It is one of the most important green leafy vegetable of the tropics, it provides minerals and vitamins (vitamin A) which are highly beneficial for the maintenance of good health and prevention of diseases (Aliyu, 2008). Nigeria is blessed by nature with vast resources; both human and land to boost optimum output in agriculture to be able to adequately cater for the food/diet requirement of her populace. The weather/climate condition supports the production of most crops. Majority of Nigerians have these endowments of nature by going into agriculture as more than 70% of the population is involved in farming (Usman, 2015), yet Nigeria is still unable to achieve 5% calorie intake of non-starch vegetable recommended by food and Agriculture organization (FAO) which could only be achieved if there are efficient production, storage, processing and distribution program. Despite the efforts being made by the government to boost food production and security in the country, the reverse is the case, as the population is rapidly increasing, the demand for vegetables has continued to rise over the years.

Green leaf vegetable farmers in Edo State are mainly peasant farmers who depend entirely on traditional farming techniques for their production and this has resulted in low farm income which has weakened financial position of smallholder farmers, a condition that has led to poor funding of their economic activities. Farming is seen as a way of life rather than a business venture by most Greenleaf farmers and this resulted to decline in production. A larger proportion of green leaf farmers mainly produce during the rainy season this indicates that vegetables are not usually produced during off seasons. Nwosu, Onyenike and Okoli (2012) reported that the constraint faced by green leaf farmers is mostly due to lack of credit facilities, lack of availability of inputs, pest and disease infestation, poor road networks and so on. Specific objectives for this study were to: examine the socio-economic characteristics of the farmers, estimate farmers technical efficiency in Green leaf production so as to determine farmers scale of production in the study area; and, identify the specific factors that Influence efficiency of farmers in the production of green leafy vegetables in the study area;

METHODOLOGY

The study was carried out in in Ovia North East Local Government Area of Edo State Nigeria. Edo State is one of the thirty-six States of Nigeria with the population of 3,233,366 and total land area of about 17,802-kilometer square. It lies approximately between latitudes 5°44'N and 7’37’’N and between longitudes 5°44 and 6'43’'E. Edo State is in a low-lying area except to the north where it is marked by undulating hills rising to a peak of about 672 meters above sea level (The Edo State Statistical Year Book, 2013). Ovia North East Local Government is one of the eighteen LGA's in Edo South, occupying a land area of 2,301 square kilometer with a population of about 153,849. The headquarter lies in Okada town consisting of thirteen political ward with its latitude lying between 5` 40" and 7` 40" North and longitude 5` 00" and 6` 30" East. The study area (Ovia North East) is a low land which rises up to approximately 100 meters in sea level which falls within the rainforest zone.

Edo State has rich soils which are high in nitrogen phosphorus and organic matter. Farming is a major occupation in Ovia North East area. Farming practices being used are crop rotation and mixed Farming. Crops grown includes yam, plantain, melon, maize, vegetables, pepper, okra and other food crops. The scope of this study covers all green leaf farmers in the study area.

The Sampling frame is made up of all farmers producing Greenleaf vegetables in Ovia North East Local Government.

A multi stage sampling procedure was used in selecting Greenleaf farmers from the study area.

Stage 1: This stage involved the selection of four towns using purposive sampling. The selected towns, Okada, Ekiadolor, Uhen and Isiuwa were chosen because there is predominant production of Greenleaf vegetable in these communities.

Stage 2: This involved the collection of lists of vegetable farmers from Edo Agricultural development office to get the sample frame of farmers in the study area

Stage 3: (30) vegetable farmers were selected through the use of simple random sampling from the four (4) Communities each giving a total sample size of 120 respondents, however only 82 respondents were found useable.

Data were collected through the use of structured questionnaire as the primary source, assisted with personal interview and through the use of relevant research, journals, publications, textbooks and internet source as the secondary source.

Technical Efficiency Analysis

The stochastic frontier production function was used to estimate the technical efficiency of the vegetable's farmers through maximum likelihood estimation procedure that jointly estimate technical efficiency and inefficiency models using the computer frontier version of 4.1. This function has been employed in studies to determine the technical efficiency of agricultural production (Erhabor and Emokaro, 2007) and Egbodion and Ahmadu (2012). The Cobb-Douglas functional form of the Stochastic Frontier used is implicitly specified as follows.

$Y_i = f(X_i B_i) + \varepsilon_i$ ……... (1)

Where:

Y= Output. B_i= parameters. X_i= vectors of inputs. ε = error term. While the model in its explicit form is given as;

$InY = Bo + B_1InX_1 + B_2InX_2 + B_3InX_3 + B_4InX_4 + B_5InX_5 + B_6InX_6 + B7InX7 + \varepsilon$ …… (2)

In = Natural logarithm. Bo = Regression Coefficient Constant Term. B_1-B_7 = coefficient to be estimated

Y. = Output. X_1 = Farm size (hectares).X2 = Quantity of fertilizer (kg). X_3 = Planting material (kg) X_4 = family labour (man-days). X_5 = Hired labour (man-days). X_6 = Depreciation (N). X_7 = Agrochemical (kg). ε = Stochastic error term. V – U …….

Where :

V = Random errors which covers random effects on production outside the control of the farmers such as weather, diseases among others. U = Randomness (technical inefficiency) which measures the influence of behavior factors which could be controlled by the farmers such as age, years spent in school, and so on.

To ascertain the specific factors that influence efficiency of farmers, Inefficiency model was employed and it's specified as follows:

$Ui = bo + b_1Z_1 + b_2Z_2 + b_3Z_3 + b_4Z_4 + b_5Z_5 + b_6Z_6 + b_7Z_7$..... (3)

Where: U_i = Cost inefficiency; bo = constant term. $b_1 – b_7$ = unknown parameters to be estimated. Z_1 = Age of the farmers (years). Z_2 = Education level. Z_3 = farming experience (years). Z_4 = Gender

of farmer (Male and Female). Z_5 = Household size. Z_6 = Occupation {Farming (1), otherwise (0)}. Z_7 = Marital status

RESULT AND DISCUSSION

Socio economic Characteristics of Respondents

Table 1: Socio economic characteristics of the Greenleaf vegetable farmers

Variables	Frequency	Percentage	Mean
Sex			
Male	34	41.5	
Female	48	58.5	
Marital status			
Married	49	59.8	
Single s	13	15.9	
Widowed	13	15.9	
Divorced	7	8.5	
Educational level			
No formal	14	17.1	
Primary	13	15.9	
Secondary	34	41.5	
Tertiary	21	25.6	
Occupation			
Farming	46	56.1	
Others	36	43.9	
Land acquisition			
Rent	17	20.7	
Family	21	25,6	
Gift	10	12.2	
Purchase	19	23.2	
Inheritance	7	8.5	
Community	8	9.8	
Land allocated to Greenleaf vegetable			
0.4	11	13.4	
0.5	2	2.4	
1.00	65	79.3	
2.00	3	3.7	
6.00	1	1.2	
Cropping system			
Mono-cropping	33	40.2	
Mixed cropping	36	15.9	
Compound farming	13	15.9	
Reasons for cultivation			
Sale	26	31.7	
Consumption	1	1.2	
Both	55	67.1	

Labor			
Family	44	53.7	
Hired	3	3.7	
Both	35	42.7	
Capital.			
Personal	67	81.7	
Credit	15	18.3	
Age			
<36	1	1.2	
36 – 50	56	68.3	49
>50	25	3o.5	
Farm size			
0.1 - 0.2	71	86.6	
2.1 - 4.0	9	11.o	1.6
4.1- 6.0	1	1.2	
>6	1	1.2	
Farming experience			
<6	7	8.5	
6- 10	29	35.4	
11 – 15	25	30.4	13
16 – 20	13	15.9	
>20	8	9.8	
Household size			
<3	10	12.2	
4 – 6	54	65.9	
7- 9	14	17.1	5
10 – 12	3	3.7	
>13	1	1.2	

Source: computed from field survey data, 2019

The major characteristics of farmers were the distribution of respondents by sex, age, marital-status, level of education, household size, occupation and farming experience as presented below. Result showed that most of the respondents (58.5%) were females while (41.5%) were male. This implies that leaf vegetable production is dominated by women in the study area, who desire to be financially supportive to their families. This finding is in agreement with the finding of Udoh, and Akpan (2007), which in their study reported that most of vegetable farmers were female.

The result also showed that most (68.3%) of the respondent fall within the age bracket of 36-50 years, (30.5%) falls within the age bracket of 50 years and above and (1.2%) falls within the age bracket of between 36 years and below. It showed the mean of the respondents to be 48 years. The age distribution of the respondents revealed that they fall within the age bracket 36 – 50 as defined by FAO, (2008) as economically productive in a population. A probable reason for this could be that majority of the youths in the study area had migrated to the urban areas to seek for collar jobs thereby neglecting farming. This findings sis in agreement with the study of Olowa and Olowa (2016) who showed that majority (51%) of pumpkin farmers were within the age bracket of 41-50 years. Result showed that most of the respondent were married, were single, were widowed and of the sample population were divorced. This implies that the married respondents provided family

labor and hence influence productivity positively. This finding support the result of Oluwatayo, *et al* (2008), who stated that married farmers tend to have large families to compliment family labour to enhance production.

Result showed that most (41.5%) of the respondents had secondary education, (25.6%) had tertiary education, (17.1%) had no formal education and (15.9%) had primary education. This implies that (83%) of the respondent had training in formal educational institutions which no doubt increases the literacy level. This finding is in agreement with Ada Okugbowa and Egbodion, (2017), who asserted that education has a positive and significant influence on farmer efficiency in production. Thus, literacy level will greatly influence the decision making and adoption of innovations by farmers which may bring about increase in productivity. The result showed that most (56.1%) of the respondent are involved majorly in farming as a source of livelihood, while the remaining (43.9%) combined farming with other business to support their income. The communities are mostly rural and this explains why majority of the respondents were into farming as major occupation. This implies that green leaf farming can be embarked upon as a sole means of livelihood and can also be combined with other activities thereby serving as a supportive means of per capital income. Farming experience is an important socio-economic factor that can bring about increase in productivity. It is a measure of the period an individual farmer was involved in Greenleaf production, the number of years of production by the farmers, the knowledge and skills gained.

Result showed that (35.4%) of the respondent's falls within the range of 6-10 years, (30.5%) falls within the range of 11-15 years, (15.9%) between 16 - 20 years, (9.8%) between 20 years and above while (8.5%) had an experience within the range of 6 years and above with a mean farming experience of 13 years. This implies that most of the green leaf vegetable farmers have been in green leaf production for a long time. This supports the findings of Onubuoge, (2013), that previous experience in agribusiness management enables farmers to set realistic time and cost targets. Result showed that most (65.9%) of the respondents household size falls within 4 - 6 persons, (17.1%) between 7 - 9 persons, (12.2%) had a household size of 3 persons and below, (3.7%) falls within 10 - 12 persons and (1.2%) had a household size of 13 persons and above with a mean of 5 persons. This implies that members of the family will supply readily available labour and this will lead to labour availability in the farm. According to the report of Ibekwe and Adesope 2010), there is a positive and significant relationship between household size and labour availability for production. It is also consistent with the result of Onubuogu, (2013), who reported that large household size compliments labour to enhance production and reduce the cost of hired labour.

Production Information

Land acquisition

The result showed that (25.6%), of the respondents made use of family land for production, (23.2%) purchased their land, (20.7%) acquired land through rent, (12.2%) got the land as a gift, (8.5%) through Inheritance and (9.8%) from their community. This implies that there is availability of land in the study area and if efficiently used can improve Greenleaf production and encourage proper utilization of land.

Result showed that majority (86.6%) of the farmers in the study area has a farm size of 0.1-2.0ha, (11.0%) has a farm size between 2.1-4.0ha, (1.2%) has a farm size between 4.1-6.0ha, and (1.2%) has farm size between 6ha and above with a mean farm size of 1.6. This showed that majority of the Greenleaf vegetable production lied in the hands of small-scale farmers whose farm size are

largely small scaled operating on less than or equal to 2.0 hectares of farm land. A probable reason could be high cost of land or tenure system that predominant in the area due to the increasing population.

The result showed that majority (81.7%) of the respondents got their capital from the personal earnings or savings while (18.3%) borrowed capital from external sources. This implies that farmers in the study area had no reliable assets to obtain loan and could be denied access to loans due to the high risk of agricultural production or due to high interest rates. The result showed that (53.7%) of the farmers in the study area made use of family labour during production process, (3.7%) made use of hired labour and (42.7%) of the farmers used both hired and family labor. The result implies that Greenleaf cultivation and tending of the farm is done majorly by the farmer and members of his immediate household due to their large family use. The result agreed with the findings of Bassey, Akpaeti and Okon (2013), whose result revealed that 66.7% of the respondents used family labor and 25% used hired labour.

Cropping system

Result showed that (43.9%) of the respondents practiced mixed-cropping, (40.2%) practiced mono-cropping and (15.9%) practiced compound farming. The result was in line with the findings of Ogisi, Begho and Ewolor (2014) whose study showed that about 95% practiced mixed cropping. This is due to the fact that farmers wanted to maximize profit.

Reason for cultivation

The result showed that (67.1%) of the farmers cultivate Greenleaf for both sale and consumption, (31.7%) cultivates for sale and (1.2%) cultivates for consumption. This implies that most of the farmers in the study area cultivates green leaf vegetable to meet their end needs.

Land allocated to leaf farming

The result showed that majority of the respondents (79.3%) allocated 1ha of land for Greenleaf production, (13.4%) allocated 0.4ha, (2.4%) allocated 0.5ha, (3.7%) allocated 2ha and (1.2%) allocated 6ha for Greenleaf production. This implies that most of the Greenleaf farmers operated on a small-scale basis.

Technical Efficiency Analysis

Table 3: Ordinary least square (OLS) and maximum likelihood estimate (MLE) stochastic frontier estimates of Greenleaf vegetable production

Variable input	OLS Estimate	t-value	MLE Estimate	t-value
(Intercept)	4.6568	0.12	2.9353***	4.63
log(fsize)	0.4645***	3.45	0.4112***	3.52
log(seed)	0.0572**	2.31	-0.0463	-0.43
log(fert)	-0.3475	-1.65	-0.3076	-1.50
log(agro)	-0.1416	-0.83	-0.0854	-0.48
log(lab)	0.2015**	2.62	0.1084	0.53
Loglike	-65.5200		-65.92	
SigmaSq			0.2895	
Gamma			0.4415**	
Z_(Intercept)			1.6243	0.04
Z_sex			0.2121	1.65
Z_age			0.0045**	2.39

Z_marital	0.1924	1.47
Z_edu	-0.0501	-0.30
Z_exp	-0.0052	-0.39
Z_hsize	-0.0071**	-2.24

Source computed from field survey data 2019; ** means significant at 5%; *** means significant at 1%

The stochastic frontier Cobb-Douglas production function and technical inefficiency model were jointly estimated in a single stage estimation procedure through the maximum likelihood estimation using computer software version 4.1 (Coelli, 1996). The maximum likelihood estimate (MLE) present better results for further economic and econometric analysis and thus was preferred. The Cobb-Douglas regression results of Greenleaf production as presented in Table 3 above revealed that the coefficient of farm size and labour exhibited positive signs and magnitude while the coefficient of fertilizer, seed and agrochemicals showed negative signs. Farm size has a positive value for its coefficient (0.4112) and was significant at 1% level of significance, this indicates that an increase in farm size will result to a proportionate increase in the output of farmers in the study area. This is consistent with *a priori* expectation and the findings of Adeoti and layemi (2003) who found that increasing farm size increased crop output of Fadama farmers in northern Nigeria. The result showed that the coefficient of labour is positive and this indicates that an increase in labour in green leaf vegetable production would result to increase in output. The coefficient for seed, fertilizer and agrochemicals were -0.0463, -0.3076 and -0.0854 and were not significant which implies that the quantity of fertilizer and agrochemicals were not in the correct proportion and also the seed used were either not viable or not used adequately. Thus, showed that an increase in their use has a negative effect on the farm output. This can be addressed by making available well-trained extension agents, who will train and guide the farmers on the use of improved varieties and application of innovations into production, also, farmers are advised to use the right dosage of agrochemicals and adhere to manufacturer instructions. The variance parameters, sigma Square was 0.2895 and It`s positive, this indicate a good fit and correctness of the distributional form assumed for the composite error term. The gamma which is the proportion of deviation from frontier that is due to inefficiency estimate was 0.4415 and is statistically significant at 5%, it shows the amount of variation resulting from technical inefficiency of Greenleaf farmers. This means that more than 44% of the variation in the farmers output is due to the differences in their technical efficiencies and 56% of their efficiency is due to random effects (such as weather, climate and so on).

Technical efficiency determinants

The result of the inefficiency is presented on the Table 3.0 above with the signs and magnitude of the coefficient variables of the inefficiency model. These are important (i.e the signs and magnitude) in the analysis and determination of technical inefficiency of Greenleaf vegetable farmers in the study area. The positive sign on the estimated parameters is an indication that the variables had negative effects in explaining technical inefficiency; hence the negative sign means reduction in efficiency. The estimates of the coefficient of age, sex, household size and marital status were positive which indicated that these variables jointly contributed to decrease the

technical efficiency of farmers in the study area and were significant at 5% level of significance. This showed that although the farmers had a large household size, not all their family members were involved in Greenleaf vegetable production. This result agrees with *a priori* expectation. However, the coefficient of education level, and farming experience were negative which indicated that these variables increased the technical efficiency of farmers in the study area, only the coefficient of household size was statistically significant at 5% level of significance. The number of years spent in school is a proxy for the literacy level of the farmers. This implies that farmers with better education are technically more efficient. These findings compare with Okugbowa and Egbodion, (2017), who reported that level of education of farmers increased farmer's efficiency. Implying increased level of education of farmer may lead to a better evaluation of importance of farming decision making, including the efficient use of inputs. The positive coefficient for marital status implies that being married means additional responsibilities for the Greenleaf farmers. The positive coefficient of age indicates that age affected the technical efficiency of the farmers, that is as the farmer gets older, his technical efficiency reduces.

Technical inefficiency can be reduced by encouraging youth to venture into green leaf vegetable production, by creating awareness about green leaf production, training of women in adopting improved practices and provision of incentives by government.

Determinants of technical efficiency

Table 4: Distribution of technical efficiency range

Efficiency level	Freq.	%
0.40 - 0.49	6	7.32
0.50 – 0.59	10	12.20
0.60 – 0.69	32	39.02
0.70 – 0.79	18	21.95
0.80 – 0.89	12	14.63
0.90 – 1.00	4	4.88
Total	82	100.00
Mean	0.58	
Maximum	0.98	
Minimum	0.41	

Source: Computed from field survey data, 2019.

The distribution of technical efficiency results range are presented in Table 4. The technical efficiency score ranges from 0.41 to 0.98 with an average score of 0.58 indicating an efficiency gap and an average farmer in the study area could increase output by about 42 percent by improving on his technical and allocative efficiency in vegetable crop production in the study area. This result support the findings of Aliyu 2006 and Onoriode (2010) who reported similar efficiency level of for jute, bitter leaf and fluted pumpkin farmers in Delta state respectively. It is observed that from this distribution that despite the variation in efficiency score about 62.0 percent of the farmers had efficiency score 0.61 and above while the worse of these farmers had profit efficiency score of 0.41 indicating that a considerable amount of output could be obtained by improving on the technical and allocative efficiencies of these farmers in the study area.

Return to scale analysis

Table. 5: Return to scale (RTS) of Greenleaf vegetable production

Production factor	Elasticity
Farm size	0.4112

Quantity of seed used	-0.0463
Quantity of fertilizer used	-0.3076
Quantity of agrochemical	-0.0854
Labor (man-day)	0.1084
Depreciation	0.1967
Return to scale	0.277

Source: Computed from field survey data, 2019

The results of the maximum likelihood estimate (MLE) model coefficient were treated as the elasticity of inputs used by the farmers in the study area. The computed Return to scale was 0.277 and positive. This result indicated an increasing-decreasing return to scale. It implies that green leaf farmers were operating in Stage ll of the production curve, which is the rational stage of production i.e production resources are well used. The farmers are thereby advised to maintain this level of production, adopt innovations, so as to improve the efficiency of their production and maximize output.

CONCLUSION

Findings from the study revealed that Greenleaf vegetable production is in the rational stage of production and that there were wide range of technical inefficiency among the farmers. It is recommended that training programs should be made accessible to farmer through extension service of government and policies directed at female farmers in the production process in the study area.

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PROSPECTS AND CHALLENGES OF THE AGRICULTURAL EXTENSION SERVICE IN THE CASSAVA MARKETING VALUE CHAIN IN EDO STATE, NIGERIA

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ABSTRACT
This study assessed the prospects and challenges of the agricultural extension service in the marketing component of the cassava value chain in Edo State, Nigeria. Specifically, the study ascertained the present services provided cassava marketers by the extension service as well as their potential role in the marketing chain based on the needs of the marketers. Data were collected from 138 marketers by means of questionnaire and analysed using descriptive and inferential statistics (multiple regression, Cochran and Friedman tests). Results revealed the dominant cassava products marketed in the study area were gari (90.6%) and fufu (63.8%). Cochran test (χ^2 = 48.66; p<0.01) revealed the most significant services respondents obtained from the agricultural extension service was information on cassava product sources (0.565), trainings on marketing (0.565) and market price information (0.551). Friedman test indicated that the most significant (χ^2 = 15.11; p<0.05) services hoped for from the extension service by the marketers were linkage with cassava tuber suppliers/farmers (mean rank = 0.99), information on market opportunities (0.99) and sources of cassava products (0.98). Chi-square results revealed household size (χ^2 = 14.40; p<0.05) was significantly related to the extension needs of the marketers. Major marketing constraints identified were inadequate finance (mean = 3.80), poor packaging/branding materials (mean = 3.72), seasonality of sales (mean = 3.71) and shortage of cassava products for marketing (mean 3.67). The study recommended that marketers be linked to tuber farmers and market opportunities to boost sale.
Key words: *cassava, marketing, agricultural extension, needs, roles, services*

INTRODUCTION
Cassava is of great value to the economy of Nigeria, and the country is the leading producer of the crop in the world. In 2015- 2017, 130 million metric tons of cassava were produced per year in Sub-Saharan Africa of which 75% was produced in 5 countries; namely Nigeria (59 million metric tons representing 45.38%), Democratic Republic of Congo (32 million metric tons or 24.62%), Ghana (18 million metric tons or 13.84%), Angola (12 million metric tons representing 9.23%) and Mozambique (9 million metric tons) (Food and Agricultural Organization-FAOSTAT, 2020 and Food and Agricultural Organization, 2018). There are many derivatives from cassava example being starch, ethanol, monosodium glutamate paper and textiles among others (Spencer & Uzodinma, 2017). At present, a wide range of traditional cassava forms (such as gari, fufu, starch, lafun, abacha, etc) are produced for human consumption (Dunstan & Chuma, 2017). Cassava products are used in various forms for consumption, livestock feed, and manufacturing of industrial products (Odunze, 2020). According to Parmamar *et al*. (2017) and Dunstan and Chuma (2017), cassava products are important input for livestock feed formulation, especially for pigs, poultry and ruminants. Cassava starch, cassava flour juice and fermented cassava are also used in industries for the manufacture of adhesives, bakery products, glucose, lactose and sucrose (Unaeze & Umeh, 2020). These products or derivatives are the outcomes of the value chains process associated with cassava.

The cassava value chain refers to the entire process of cassava production/cultivation, extending to the processing activities, distribution and marketing of the product, and identifies the main stakeholders involved at each stage, including research and development (Temidayo, 2019). Actors involved in the cassava value chain encompass both farmers/producers and processors including marketers. Sadiq, Singh and Karmakaran (2017) reported that the growth rate of cassava declined from 7.3% in 2014 to 4.7% in 2017. This situation highlights the need for determined efforts to accelerate the cassava production growth process. This will require that the associated value chain process be pursued including processing and marketing. According to Nwosu and Ogbonnaya (2014), this will require exploiting the benefits of the crop at both the production phase as well as exploiting other derivable products as a result of processing and how these products are communicated to consumers. However, output increases is necessary but insufficient condition. A missing link in the cassava value chain development is processing and marketing in particular (Ahmadu & Idis, 2014).

A key factor in the development of the cassava value chain is the agricultural extension service. Any strategy attempting to enhance the cassava value chain will require input from the extension service. The success of such a strategy will require understanding the present and potential roles of the agricultural extension agency in the cassava value chain process, especially from cultivation to marketing. In fact, it has been asserted that extension education is an important means through which the desired increase in the agricultural land productivity of the farming community can be brought about (Alhassan, Umar & Ayuba, 2019). However, a major challenge has been that the role of the extension service in the marketing arm of the cassava value chain is not clearly defined (Odunze, 2020). Given the dearth of literature on the activities of the agricultural extension service in cassava marketing as opposed to cassava production, one can insinuate that, probably, little or nothing is being play by the service in cassava marketing development. In fact, it has been argued that the extension service has neglected the processing arm and marketing of the value chain process (Nwosu & Ogbonnaya, 2014). This suggests possible gap between the extension service and cassava marketers (Obinna & Chukwu, 2015). However, how true is this situation in the in the study area is the focal point of this study. It is in the light of the above that it becomes necessary and important to examine the extension service present and potential role in the marketing arm of the cassava value chain in Edo State.

The overall aim of the study is to assess the role played by the agricultural extension services in the marketing arm of the cassava value chain in Edo State, Nigeria. The specific objectives are to: describe the socioeconomic characteristics of marketers involved in the cassava value chain in selected areas of Edo State; ascertain the present and prospective roles of the agricultural extension service in the marketing arm of the cassava value chain in the study area and identify constraints associated with the marketing of cassava.

The following null hypotheses were tested.

H_{O1}: There is no significant relationship between the socioeconomic characteristics of the cassava marketers and their agricultural extension needs.

H_{O2}: There is no significant differences in the present roles of the agricultural extension service in cassava marketing value chain.

H_{O3}: There is no significant differences in the prospective roles of the extension services in the marketing arm of the cassava value chain process.

METHODOLOGY

This study was conducted in Edo State of Nigeria. The state is made up of three geo-political zones namely Edo south, Edo Central and Edo North zones. These zones have 18 local government areas (LGAs), a land area of 19,794km^2 with a population of 4,235,595 in 2020. The research design is quantitative in nature, relying on survey procedure and primary data, sourced directly from cassava marketers. Snowball technique was employed in the sampling of the respondents. This was

informed by the absence of formal data or record on the population of cassava marketers. The first stage was the purposive selection of the three agricultural zones in the State, namely Edo central, Edo south and Edo north. Secondly, three LGs were randomly sampled while three major markets were each was purposefully chosen in the selected LGs. The last stage involved the use of snowball sampling to select, 58, 40 and 40 marketers from Edo central, Edo south and Edo north zones respectively. This gave a total of 138 marketers used for the study.

Information was sourced from the respondents by use of validated question instrument. Data collected was analysed using descriptive statistics, Chi-square, Cochran and Friedman tests.

Friedman rank test

Friedman rank test of difference was used to determine significant differences among the expected roles of the agricultural extension service by the marketers. This test is applicable when the data to be analysed is ordinal, and it used to test the significant differences in treatments across multiple variables Ikponmwosa (2014). The formular is given as:

$$\mathbf{F_R} = \frac{\mathbf{12}}{rc\left(c+\mathbf{1}\right)} \sum_{j=i} \mathbf{R^2}_{j-3.\left(c+1\right)} \quad \text{………………………………….. ……………..} \ (1)$$

Where: R_j^2= Square of the total ranks for group j (j = 1, 2…. c); r = number of blocks; C=number of groups/factors

Cochran Test

The Cochran Q test is used to determine if there are differences on dichotomous dependent variables between three or more related groups (Omoregie, Onemolease & Orhibo, 2020). This test was used to analyse the present roles of the agricultural extension service in cassava marketing as perceived by the marketers in the study area. The formula is given as:

$$Q=\frac{K-1\left[\mathrm{k}\sum_{\mathrm{j}-1}^{\mathrm{k}} \mathrm{G_J^2} - \left(\sum_{\mathrm{j}-1}^{\mathrm{K}} \mathrm{G_j}\right)2\right]}{\left[k\sum_{j-1}^{N} Li - \sum_{i-1}^{N} Li^2\right]}$$

Where: Q=Test statistics; K=Number of columns; G=Column total; N=Number of Rolls; L=Rolls total. The Q statistics follows the Chi-Square distribution with; df =k-1

Chi-Square Goodness-of-fit test

Chi-square goodness of fit is used to test a sample of data from a population with a specific categorical distribution (Ogunniyi & Ojebuyi, 2016). The formula is given as:

$$x^2 = \sum_{1=1}^{\mathrm{K}} (0_i - E_i)\, 2/E_i$$

Where: 0_i=observed frequency; E_i=expected frequency

Operationalization of variables

Present roles of the agricultural extension service in cassava marketing: Respondents response on the support received from the agricultural extension service in their marketing activities were captured as binary response, i.e., '*Yes'* or '*No'*.

Agricultural extension needs of marketers (prospective role of agricultural extension): The marketers were asked areas in which the extension service can support their enterprise, and their answers coded on a four-point Likert type scale of '*very important'* (coded 4), '*important'* (3), '*little important'* (2) and '*not important'* (1). An expected assistance with a score above the weighted mean of 2.50 indicate an important need, while a score less than 2.50 indicate otherwise. The weighted mean was determined as follows: *(4+3+2+1) / 2 = 2.50*

Constraints associated with the cassava tuber production: This was measured by rating constraints on a four-point Likert-type scale of '*very severe'* (coded 4), *severe* (3), *little severe* (2) and '*not severe'* (1). A constraint score below the weighted mean (i.e., 2.50) is considered not serious while a score above 2.50 indicate otherwise.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Value cassava tuber cultivators

Table 1: Socioeconomic characteristics of cassava marketers

Characteristics	Options	Freq (n=138)	%
Age range (years)	21-30	17	12.32
	31-40	45	32.61
	41-50	55	39.86
	51-60	18	13.04
	61-70	3	2.17
Sex	Female	77	55.8
	Male	61	44.2
Marital status	Single	15	10.87
	Married	89	64.49
	Divorced	20	14.49
	Widowed	14	10.14
Household size	1-4	47	34.06
	5-8	64	46.38
	9-12	18	13.04
	13-16	9	6.52
Educational level	No formal education	27	19.57
	Primary education	24	17.39
	Secondary education	40	28.99
	Tertiary education	47	34.06
Marketing experience (years)	≤10	41	29.71
	11-20	54	39.13
	> 20	43	31.16
Income range (in naira)	100,000 & below	46	33.34
	100,001 - 200,000	73	52.9
	200,001 - 300,000	17	12.32
	>300,000	2	1.45

Field survey, 2018

Table 1 shows the age distribution of the cassava marketers. The pooled result shows the highest proportion of the marketers (39.86%) was 41-50 years with an average age of 41years. This finding implies that majority of the marketers were of average age, having the physical strength to engage in the marketing activities. Similar finding was reported by Adisa, Olatinwo and Shola-Adido (2013), who found the average age of cassava marketers in Kwara State to be 41 years. Majority of the marketers (55.8%) were female while male constitute 44.2%. Ngbakor, Uzendu and Ogbumiuo (2013) have reported high female participation in cassava marketing in Delta State relative to production and processing activities. The majority (64.49%) of the marketers were married, 14.49% were divorced, 10.87% were single while 10.14% were widowed. Temidayo (2019) reported 88% of their sampled cassava product processors and marketers as married. Thus, most marketers were

married, suggesting a major motivation for engagement in this enterprise is to cater for their families. This supports the assertion of Adisa *et al.* (2013), who reported that most participants in cassava value chain activities, including marketing, were married people, who participated in order to improve their status.

Household size for majority of the cassava product marketers was 5-8 persons (46.38%) followed by 1-4 persons (34.06%), the average being 6 (Table 1). The result implies that the respondents had people depending on them and which they need to cater for. Other studies have reported similar findings; for example, Adisa *et al.* (2013) reported a household size of 4-6 persons (59.0%) for cassava marketers in Kwara State, Nigeria. The educational level of cassava product marketers revealed that higher proportion of them had secondary education (34.06%) followed by secondary school certificate holders (28.99%). The modal marketing experience of the respondents was 5-10 years (29.71%), with an average of 16. This implies that the respondents were experienced in cassava marketing, which places them in better position to have first-hand knowledge of the challenges and needs associated with cassava marketing. This agrees with the Okwokenye and Onemolease (2011), who noted that having long farming (enterprise) experience enables the farmer to understand better the needs and problems associated with his/her enterprise. The modal annual income of the marketers was ₦100,001-200,000 (52.9%), while the average annual value was ₦134,058.39. This is quite low, suggesting the marketers were likely retailers operating on small-scale basis.

Cassava products marketed by respondents

The major cassava products marketed by the respondents were gari (90.6%) and fufu (63.8%) (Fig. 1). Other were cassava stem (48.6%), tapioca (42%), starch and flour (20.3% each). Temidayo (2019) reported that gari (90.6%) and fufu (63.8%) were major products processed and marketed in his study.

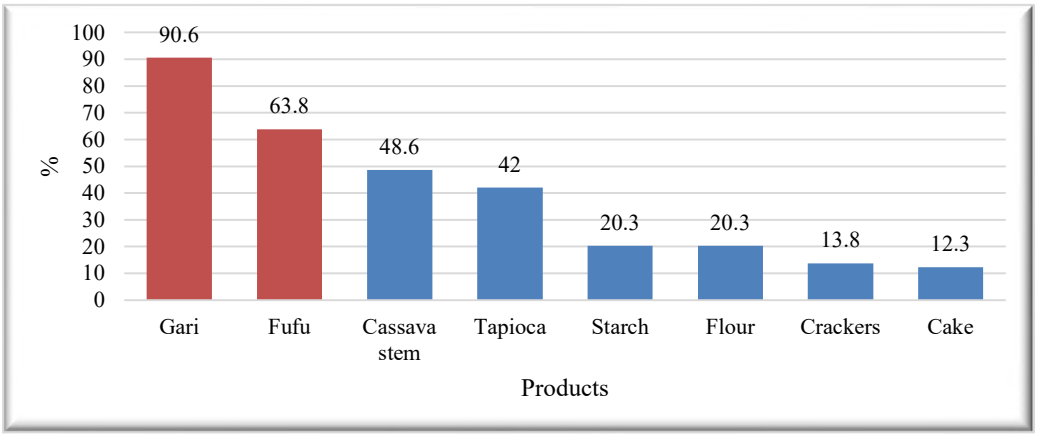

Figure 1: Cassava products marketed by respondents

Field survey, 2018

Extension Contact with Value Chain Actors

Figure 2 show that majority of the cassava product marketers (91.3%) had contact with extension agents at least once in six months. This contact could help them improve on enterprise by improving their market linkages, which could boost income and livelihood. Studies by Adisa *et al. (*2013) revealed extension contact was the most important sources of information for most (80%) cassava product marketers.

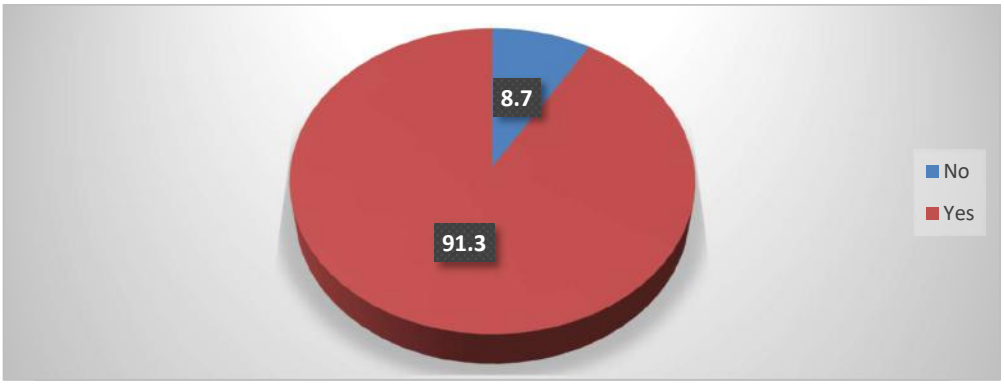

Figure 2: Extension contact with value chain actors (%)
Field survey, 2018

Present roles of the extension service in cassava marketing

Table 2: Present roles of the extension service in cassava marketing

Extension Roles	Freq	%
Training on cassava marketing (e. g. marketing strategies, profit analysis, etc.)	78	56.5
Provide information on cassava products availability /sources	78	56.5
Provide information on market prices	76	55.1
Provided information on market opportunities i. e. where to market	70	50.7
Linkage to cassava produce/product suppliers/farmers	64	46.4
Organization of marketers into groups to transport products to market	37	26.8

Field survey, 2018

Table 2 reveals that the major areas in which the marketers had benefitted from the extension service were training on cassava marketing (56.5%), and information on cassava product availability/sources (56.5%), market prices (55.1%) and market opportunities (50.7%). Linkage to cassava produce/product suppliers/farmers (46.4%) and organization of marketers into groups to transport products to market (26.8%) were the least services the marketers have gained from the extension service.

Prospective roles of agricultural extension service in cassava marketing

Table 3: Prospective roles of the agricultural extension service in cassava marketing

Expectations	**Freq**	**%**
Provide information on market opportunities i.e. where to market	136	98.6
Link marketers to cassava produce/product suppliers/farmers	136	98.6
Provide information on cassava products availability /sources	135	97.8
Provide information on market prices	133	96.4
Organize marketers into groups to transport products to market	132	95.7
Train marketers on cassava marketing (e. g. marketing strategies, profit analysis, record keeping etc	128	92.8

Field survey, 2018

Table 3 shows the prospective or expected roles of the extension service in cassava product marketing in the study area. The result of the table revealed that all the six listed areas of extension prospective or expected roles were considered important or needed by the marketers. These include information on market opportunities to locate where to market (98.6%) and linkage to cassava produce/product suppliers/farmers (98.6%), information on cassava products availability/sources

(97.8%), information on market prices (96.4%), organize marketers into groups to transport products to market (95.7%) and training on cassava marketing (92.8%). The finding implies that the marketers in the study area have important diversified needs can affect the effectiveness and efficiency of their marketing activities. Similar need of agricultural marketers has been noted by Stella *et al.,* (2013).

Constraints facing cassava marketers

Table 4: Constraints facing cassava marketers

Constraints	Mean*	SD
Lack of or inadequate finance	3.80	.42
Poor packaging/branding material	3.72	.54
Seasonality of market	3.71	.53
Shortage of cassava products for marketing	3.67	.49
Theft of products	3.65	.58
Bad condition of roads	3.63	.50
High transport cost	3.59	.51
Inadequate market information e. g. lack of information about product prices	3.58	.54
Lack of training on how to improve marketing	3.57	.53
Low customer patronage	3.13	.87

Serious (mean ≥ 2.50)
Field survey, 2018

Table 4 shows that the marketers considered all the constraints listed serious, based on the mean benchmark of 2.50. The major constraints included lack of or inadequate finance (mean = 3.80), poor packaging/branding materials (mean = 3.72), seasonality of sales (mean = 3.71), shortage of cassava products for marketing (mean 3.67), theft of products (mean = 3.65), poor condition of roads (mean = 3.63), high transport cost (mean = 3.59), inadequate market information (mean = 3.58) and lack of training on how to improve marketing (mean = 3.57). The inadequate finance, as a major constraint, may be because most marketers do not have access to formal credit (Nwosu and Ogbonnaya (2014). These findings agree with that of Stella *et al.* (2013), who also noted that the constraints faced by agricultural marketers included lack of finance, marketing problems, transportation problems and inadequate storage facilities.

Test of difference in present role of the extension service in cassava marketing

Table 5: Test of difference in present role of the extension service in cassava marketing

Extension roles	Response proportion
Provide information on cassava products availability /sources	0.565[a]
Training on cassava marketing	0.565[a]
Provide information on market prices	0.551[a]
Provided information on market opportunities i. e. where to market	0.507[b]
Linkage to cassava produce/product suppliers/farmers	0.464[b]
Organization of marketers into groups to transport products to market	0.268[c]

(Source: Computed from field data, 2018); $\chi^2 = 48.66$; $df = 5$; $p < 0.01$

Cochran test was used to analyse the significance of the difference in the support/services provided for cassava marketers by the agricultural extension services (Table 5). The test result ($\chi^2 = 48.66$; $df=5$; $P<0.01$) was significant, meaning that a significant difference existed among the present role of the extension service to cassava marketers in the study area. This implied that some roles of the extension service were considered more significant than others. The post-hoc test showed that information on cassava products sources (0.565), trainings on cassava marketing (0.565) and

provision of information on market prices (0.551) were the most significantly roles of/or services provided by the extension service to cassava marketers in the study area. The result also showed there were no significant differences in the present roles of the extension service to cassava marketers on providing farmers (marketers) with information on market opportunities (0.507) and linkage to product suppliers/farmers (0.464). The least significant role of the extension service in the cassava marketing value chain was organization of marketers into groups to transport products to markets (0.268).

Test of difference in prospective role of the extension service in cassava product marketing value chain.

Table 5: Test of difference in prospective role of the extension service in cassava product marketing

Prospective roles	Mean rank *
Linkage to cassava produce/product suppliers/farmers	0.986[a]
Provided information on market opportunities i.e., where to market	0.986[a]
Provide information on cassava products availability /sources	0.978[a]
Provide information on market prices	0.964[ab]
Organization of marketers into groups to transport products market	0.957[ab]
Training on cassava marketing	0.928[b]

$\chi^2 = 15.11$; df = 5, p< 0.05;
**Means with similar superscripts are not significantly different.*
Source: Computed from field data, 2018

Friedman test for differences in the prospected roles of the agricultural extension service in cassava marketing was significant ($\chi^2 = 15.11$; $df = 5$, $P<0.05$), implying that a significant difference existed among the prospective or expected roles of the extension service in cassava marketing in the study area. The post-hoc test revealed that linking marketers with cassava suppliers/farmers (mean rank = 0.99), providing information on market opportunities (0.99) and information on cassava products sources (0.98) were among the most significant expected roles of the extension service in cassava marketing. Training marketers on marketing issues (mean rank = 0.928) was among the least significant prospective roles of the extension service in cassava tuber marketing. Thus, there are significant agricultural extension needs among the cassava product marketers.

Relationship between the socio-economic characteristics of cassava product marketers and their extension needs

Table 6: Relationship between the socioeconomic characteristics of cassava marketers and their extension needs

Independent variables	Chi-square (χ^2)	df	Prob. Level	Decision
Age	8.51	4	0.074	Not Significant
Marketing experience	7.40	5	0.192	Not Significant
Educational level	10.09	5	0.073	Not Significant
Contact with Extension agents	0.39	1	0.531	Not Significant
Household size	14.40	3	0.002	Significant
Income	6.50	6	0.369	Not Significant
Marital status	4.58	3	0.205	Not Significant
Sex	3.26	1	0.071	Not Significant

Dependent variable (extension needs): High need = 134 (97.1%); low need = 4 (2.9%)
Source: Computed from field data, 2018

Chi-square results indicate that only household size was significantly related to the extension needs of the marketers ($\chi^2 = 14.40; p<0.05$) (Table 6). It is possible that marketer with large households had higher need for extension services because they wanted to earn more income to cater for their large families. This assertion agrees with that of Nwosu and Ogbonnaya (2014), that having people to cater for can be a motivating factor to compel individuals, and indeed marketers, to have high need for extension service in order to adequately engage in extension activities.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made:

i. Inadequate finance/capital was the major constraint faced by all the cassava value chain actors in the study area. It is therefore suggested that the cassava value chain actors be linked to credit sources/providers such as micro-finance bank to access fund so as to enable them finance their value chain activities.

ii. Scarcity of improved planting materials and other inputs was identified as a serious constraint by the cassava tuber producers. It is therefore recommended that the extension (ADP) should link the farmers to input suppliers.

iii. A way to encourage farmers' access to farm inputs is to promote group formation among the value chain actors to enable them access or purchase farm inputs in bulk. Buying these inputs in bulk will reduce the unit cost for each farmer. Encouraging group formation will also make it easy for the farmers to equally access credit and also engage in bulk transportation of produce/products.

iv. The government should construct accessible roads linking rural/interior areas where most of the cassava tubers are produced for transportation of cassava tubers to urban areas. This will ameliorate the problem of transportation identified by the respondents as a result of high transport cost or bad roads.

v. Training/capacity building programmers should be organized for the farmers by the extension (ADP) for all the actors involved in cassava value chain. Such trainings should focus on cassava stem treatment, land clearing/preparation methods, credit sources, and excursions to processing industries, market opportunities and cassava product marketing.

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PRICE DYNAMICS AND STABILIZATION POLICY EFFECTS ON INDUSTRIAL FISHERIES SUPPLY IN NIGERIA: 1980-2014

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ABSTRACT
One of the objectives of stabilization policy in any economy is to maintain constant prices of goods and services, it is against this backdrop that this study is carried out to examine how price dynamics and stabilization policies effects the industrial fisheries prices and supply in Nigeria, 1980-2014. Secondary data on industrial fisheries supply, demand, price, exchange rate, interest rate, taxes, agric credit, inflation, covering 1980-2014 were obtained from Central Bank of Nigeria, (CBN), National Bureau of Statistic (NBS), Federal Department of Fishery (FDF), Food and Agriculture Organization (FAO), and Nigeria Institute of Oceanography and Marine Research, (NIOMR). The various analytical tools used were, Augmented Dickey Fuller Test to check for the stationarity of the data; four functional forms, log, linear, semi-log and exponential of simple regression model were used to analyse the effect of price on supply, two-stage least square regression model was used to analyse the effect of stabilization policies on industrial fish supply. The result of the simple regression model showed that supply of industrial fish had effects on the price as they were statistically significant at P Values of 0.027, 0.029, and 0.059 respectively for double log, semi-log and exponential models. The Two-Stage Least Square regression result showed that stabilization policies had effect on the supply of industrial fish. The study concluded, that the price dynamics and stabilization policies had effects on the supply of industrial fisheries in Nigeria. Based on these findings, it was recommended that stabilization policy be strengthened in other to regulate prices, exchange rate, interest rate, agric credit and taxes so as to stimulate better supply of industrial fisheries in Nigeria.
Keywords: Price, Policies, Dynamics, Industrial, Fishery, Supply

INTRODUCTION
In Nigeria like every other coastal countries, fish is highly valued because it is one of the cheapest sources of protein (Abubakar et al, 2018) due to supply gap, prices are highly volatile. Statistical survey had shown that the demand for fish in Nigeria exceeds supply and domestic production is very low despite the abundant water resources. The production level in the industrial fisheries subsector in Nigeria indicates that there was growth in 1970s, sharp decline in the 1980s (Okidim & Okuduwor, 2018). This was not attributed to output alone, but also to local and international prices. Okidim and Ibekwe (2018) reported that the price is a monetary expression of value; it's an important element that determines volume of output and goods sold. Price is the amount of money consumers pay for a product or service. Price is very much uncontrolled variable for agricultural producers in short run, the fisheries industries are not exceptional and this is because the fisheries market or industries is a homogenous market and cannot influence demand and price especially in the short run when most inputs cannot be varied. To solve this problem, it is believed that stabilization policy or policy mix is inevitable.

Stabilization policy changes is the change in swing of money supply, interest rate and credit supply as well as government revenue/taxes and borrowing (Sani et al, 2018).

The combination of fiscal and monetary policies is called stabilization policy, the combined effect of these polices can regulate prices through regulation of cost of money (interest rate) (Ajisafe & Folorunso, 2015). Stabilization policy is aimed at price stability. According to Bovin (2019) stabilization policy is mostly used to regulate price variation. Fish producers are regarded as price takers, meaning that they are not monopolists, they do not fixed prices and they do not regulate their output, this does not motivate fishers because fish prices are not sustainable due to unfavourable macro-economic policies that do not favour fish industries. Price is an incentive for greater output, (Ekine & Okidim, 2013). In the past, government has adopted various macro-economic policies such as money supply, exchange rate, interest rate etc. to create favourable economic environment for fish industries to grow, most of these are deregulation policy, policy on subsidy, price guarantee policy, fisheries agreement, trade and fisheries management. Price dynamics is an important factor in determining fish output. Price information is an important variable in determining fish output and industrial fisheries growth. Fish is more of consumer goods than a producer or industrial goods and can highly be impacted by fluctuation in prices and consumer spending. Consumers spending constitute up to 70% of the Gross Domestic Product and is said to be a determinant of macro-economic performance. Increase in fish prices brings about a decline in consumer aggregate spending on fish. Increase in government spending on fisheries industries growth can stimulate growth and enhance better prices (Okidim & Eze, 2018).

Fish is one of the most internationally traded food, the value of global fish trade exceeds the value of international trade of all other animal proteins combined (World bank, 2017). Fish trade has and export value of 129 billion dollar annually, with about 70 billion dollar from less developed countries (Food and Agriculture Organization, 2014) of this figure, small scale fisheries contributed about half the global fish catch. Macro-economic dynamics have not been able to control fish output through price control, marine policy, ocean fisheries and cultured fisheries (Okidim & Ibekwe, 2018) If macro-economic policy could be tailored towards increasing small scale fisheries, output will be increased, high risk of captured fisheries investment could be mitigated by good fiscal and monetary policies (Mahendra & Juersen, 2013). It is against this backdrop that this study seeks amongst other things to; examine the effect of fish prices on industrial fishery supply in Nigeria and analyze the effect of stabilization policies on industrial fishery supply in Nigeria.

Hypotheses of the Study

H_{01}: There is no significant relationship between industrial fisheries supply and their price.

H_{02}: Stabilization policies have no significant effect on industrial fisheries supply in Nigeria.

METHODOLOGY

The study on price dynamics and stabilization policy effect on industrial fisheries supply from 1980 to 2014 was carried out in Nigeria. Nigeria has a coastline of 853 km which borders the Atlantic Ocean in the Gulf of Guinea in the south. The states along the coast are: Akwa Ibom, Bayelsa, Cross River, Delta, Lagos, Ogun, Ondo and Rivers. These waters include the continental shelf along more than 800 kilometers of coastline. Apart from these interruptions and some offshore oil prospecting installations, the shelf is considerably trawlable.

Secondary data were used for the study, a time series data for industrial fisheries supply were obtained from Nigeria Institute of Oceanography and Marine Research (NIOMR), Federal

Department of Fisheries (FDF), Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS), covered 1980 to 2014.
Data for this study were analyzed using four functional forms of double log, linear, semi log and exponential form. Simple regression models were used to examine the effects of price on supply of industrial fish. Two stages least square regression model was used to analyzed the effects of Stabilization policies on industrial fisheries supply in Nigeria.

The model of the ADF test with the constant term and trend is as follows:

$$\Delta Y_t = \alpha_1 + \alpha_2 t + \beta Y_{t-1} + \sum_{i-1}^{n} \theta_1 \Delta Y_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where ΔY = changes in industrial supplies

Simple regression model:

Double log:

$$lnP = \beta_0 + \beta_1 \ln s_t \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Linear:

$$P = \beta_0 + \beta_1 s_t \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Semi-log:

$$P = \beta_0 + \beta_1 \ln s_t \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Exponential

$$\ln P = \beta_0 + \beta_1 s_t \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Two Stage Least Square Regression Model

The two stage least square (2SLS) regression model is specified as

$$QS_t = \beta_0 + \beta_1 PR_t + .\beta_2 ITR . + \beta_3 CF_t + \beta_4 EXR_t + .\beta_5 IF_t + \beta_6 TAX_t + \varepsilon_{2t} \ldots\ldots \quad (6)$$

$$Qd_t = \alpha_0 + \alpha_1 PR_t + .\alpha_2 ITR . + \alpha_3 CF_t + \alpha_4 EXR_t + .\alpha_5 IF_t + \varepsilon_{2t} \ldots\ldots \quad (7)$$

Where

Qd = Quantity demanded of industrial fish (kg)
Qs = Quantity supply of industrial fish(kg)
PR = Price of industrial fish supply in (₦)
ITR = Interest rate (naira)
CF = Credit facilities (agric credit) (naira)
EXR = Exchange rate(naira)
ITR = Interest rate (naira)
IF=Inflation(cpi)(naira)
α And β = parameters to be estimated
ε = white noise or error term

RESULT AND DISCUSSION

Table 1: Showing industrial fish output yearly, price, interest rate, exchange rate and inflation rate

S/NO	Year	Fish Out Put (in million tons)	Price (1000 tones in naira	Interest Rate	Exchange Rate	Inflation Rate
1	1980	25,679.2	25	8.10	0.712	10.66
2	1981	25,914.9	25	9.80	0.762	
3	1982	25,988	26	8.30		
4	1983	24,793.6	28	9.98	0.7241	11.50
5	1984	26,443.9	24	10.24	0.7649	13.00
6	1985	29,116	44	9.43	0.8938	11.75
7	1986	30,409.7	70	9.96	2.0206	12.00
8	1987	50,670	63	13.96	4.0179	19.20
9	1988	56,314	64	16.62	7.3916	17.60
10	1999	53,226	69	20.44	8.0378	24.60
11	1990	125,211	126	25.30	9.9095	27.70
12	1991	23,568	10	20.04	17.2984	20.80
13	1992	36,662	24	24.76	22.0511	31.20
14	1993	34,885	12	31.65	21.8861	36.09
15	1994	34,693	20	20.48	21.8861	21.00
16	1995	33,479	39	20.23	21.8861	20.79
17	1996	27,244	33	19.84	218860	20.86
18	1997	27,703	21	17.80	92.34	23.32
19	1998	29,954.8	40	18.18	101.70	21.34
20	1999	31,139.4	34	20.29	111.23	27.19
21	2000	23,308.3	52	21.27	120.58	21.55
22	2001	28,378	49	23.44	137.76	21.35
23	2002	30,091	28	24.77	133.14	30.19
24	2003	33,882	13	20.71	137.70	22.88
25	2004	30,421	25	19.18	129.93	20.32
26	2005	32,595	20	17.95	128.37	19.49
27	2006	33,778	29	16.90	117.72	18.70
28	2007	26,193	29	16.94	146.59	18.36
29	2008	27,621	29	15.48	150.33	18.70
30	2009	27,894	28	18.36	152.08	22.62
31	2010	24,228	27	17.59	161.31	22.51
32	2011	24,269	28	16.02	156.96	22.42
33	2012	24,742	28	16.79	196.13	23.79
34	2013	23,946	28	16.72	282.2	24.94
35	2014	23,877	28	16.55		25.50

Source: Central bank of Nigeria various issues; Okidim, I. A. & Tuaneh, G.L. (2019)

The Effect of Price on Industrial Fish supply

This was analyzed using four functional forms of simple regression model, linear, semi-log, double-log, and exponential as captured on the displayed Table 2. The result on Table 2, shows that, the double log, semi-log and exponential functions showed that the price of industrial fish

is statistically significant at P values of 0.027, 0.028, 0.059, respectively, at 5% level of significant, this implies that a unit change in quantity supply of industrial fish may lead to 0.059 percent change in price of the industrial fish supply. This result established a clear relationship on the responsiveness of supply of industrial fishes to price, the significance of this relationship in macroeconomic theory cannot be ruled out, as it is also applicable to other sectors of the economy, the equilibrium market price of fish are usually not constant, a decrease in price of fish may encourage the buyer to purchase more quantity than formally expected, the opposite may be experience if the price increases, both supplier and buyer may also react to price as it response to season, for instance, dry season does not encourage long stay of fresh fish, at such season the supplier may be force to dispose his/her product without much haggling on the price, season also influence the production and multiplication(breeding) of fishes; this also directly cultured the behavior of both fish traders and fish consumers, in a season of natural scarcity of fish, consumer tend to pay more price making more profit margin for the dealers at every marketing point. According to (Okidim & Ibekwe, 2018) the supply of fish also depend on price of substitutes.

Table 2: **Estimates of Effect of price on Quantity Supplied on Industrial Fish using double log, Linear and Semi-log and Exponential functional forms**

Variable/Functional Form Dependent variable=Price	Coefficient	Standard errors	t-statistics	P values
LINEAR				
Indust. Fish qty ss	-13.89366	8.594336	-1.62	0.115
Constant	1634.4	349.0915	4.68	0.000
F-statistics =	2.61			0.1155
R-squared =	0.0734			
SEMI-LOG				
Indust. Fish qty ss	-0.01586	0.0697	-2.29	0.029
Const.	7.2263	0.2832	25.51	0.000
F-statistics =	5.18			0.0295
R-squared =	0.135			
EXPONENTIAL				
Indust. Fish qty ss	-704.191	359.9556	-1.96	0.059
Const.	3558.503	1243.344	2.86	0.007
F-statistics =	3.83			0.058
R-squared =	0.1039			
Number of observations =	35			

Source: Data Analysis (2019).

The Effect of stabilization Policies on Industrial Fish Supply

Stabilization policies variables considered for this study from both monetary and fiscal policies were exchange rate, interest rate, inflation rate. Two stage least square regression model was used, at the first stage three functional functions were used: double log, semi log and linear, and the problem of exogeneity with the error term was suspected, the variables were not correlating with the error terms as shown on Table 3. According to Okidim & Eze (2018), for stabilization

policy to be effective and have effect on prices, there must be interplay of government and monetary authorities to find actual level of economic activities with regard to income, output and prices.

Table 3: Estimating the Effect of Stabilization Policies variables on Industrial Fish Supply

Industrial Fish Quantity Supply	**Co-efficient**	**Standard. Error**	**T.statistic**	**P>|t|**
Linear				
Price/ton	-.0100917	.0030674	-3.29	0.003
Agric credit	.0000437	.000029	1.51	0.144
Exchange rate	-.2283183	.0541061	-4.22	0.000
Tax	-1.125646	.9530585	-1.18	0.248
Inflation	-.028903	.1296367	-0.22	0.825
Interest	1.016228	.3475517	2.92	0.007
Cons	48.62207	13.95718	3.48	0.002
No of observation	35			
F.Statistics	0.0031			
R.Square	0.5200			
Adjusted R.Square	0.3955			
Double log				
Price/ton	-.2549479	.0939937	-2.71	0.011
Credit facilities	.0916924	.0748091	1.23	0.231
Exchange rate	-.0802134	.0381917	-2.10	0.045
Tax	-.0058165	.1700257	-0.03	0.973
Inflation	.0619358	.0551388	1.12	0.271
Interest	.225859	.0816035	2.77	0.010
Cons	3.762626	1.275132	2.95	0.006
No of observation	35			
F.Statistics	0.0184			
R.Square	0.3997			
Adjusted R.Square	0.2711			
Semi-log				
Price/ton	-.0002435	.0000747	-3.26	0.003
Credit facilities	1.17-006	.7006807	1.66	0.108
Exchange rate	-.004569	.0013171	-3.47	0.002
Tax	-.0001397	.0231995	-0.01	0.995
Inflation	.0009534	.0031556	0.30	0.765
Interest	.0249991	.0084602	2.95	0.006
Cons	3.4297	.3397485	10.09	0.000
No. of observation	35			
F.Statistics	0.0071			
R.Square	0.4841			
Adjusted R.Square	0.3503			

Source: Data Analysis (2019)

From the result on Table 3, the three functional equations shows that only interest rate and exchange rate as policies variables were statistically significant at 5% level. The result of the four functional forms showed that all the stabilization policy measures were negative in relation to industrial fish supply, it shows that the endogenous variable is weak and the results were not reliable this consequently lead to the option of employing quantity demanded as an endogenous variable in the analysis as shown on Table 4. This negates the study of Agu et al (2014) which report that initial level of government expenditure i.e fiscal policy on agricultural output can actual bring about improvement in output supply especially when it complemented with stable macroeconomic policies that will enhance price ratio.

Table 4: Estimating Stabilization policies using quantity demanded as an endogenous variable

Qty dd tones	Co-efficient	Standard. Error.	t.statistics	P>|t|
Agric Credit	1.17-006	.7006807	-3.26	0.108
Exchange rate	4409019	.2994201	1.47	0.151
Tax	3.208556	5.792666	0.55	0.584
Inflation	-.0504946	.7973404	-0.06	0.950
Real interest rate	-2.2207	2.165851	-1.03	0.313
cons	111.1299	66.65658	1.67	0.106
no. of observation	35			
f. statistics	0.4208			
R. square	0.1138			
Adj. R. square	0.0007			

Source: Data Analysis (2019).

The Table 4 also indicated that the variables were not statistically significant, meaning that within the period of study the selected variables such as interest rate, exchange rate never had any significant impact on fish supply. Therefore, an instrument variable that the dependent variable has effect on was chosen (price) as shown in the first stage regression summary statistics Table 5, while other variables were constant.

Table 5: First Stage Regression Statistic

Variable	R.square	Adjusted R-square	Partial R-square	F.statistics	Prob.>F
Price/ton	0.4331	0.2678	0.1346	3.7318	0.0653

Source: Data Analysis (2019)

The Table 5 shows that price is statistically significant at 0.0653, this suggest the validity of the price instrument used in the first regression equation to overcome the problem of erogeneity of the error term. The two stage least square regression model was displayed on Table 6, using price as an endogenous variable. The result captured on Table 6 shows that, credit facilities, exchange rate, interest rate, where statistically significant at P values of 0.058, 0.098, 0.067, 0.048 respectively, this implies that both the monetary and fiscal policies of government have effect on the supply of industrial fish in Nigeria, this implication reject the null hypotheses of non-significant effect of stablization policies on industrial fish supply in Nigeria.

Table 6: Estimating Stabilization Policies using Price as an Endogenous Variable on Industrial Fish Supply

Dependent variable (Price/ ton)	Coefficient	Standard Error.	t statistics	P>|t|
Agric credit	-.0068897	.0034538	-1.99	0.058
Exchange rate	-6.083315	3.531581	-1.72	0.098
tax	-148.1655	57.48293	-2.58	0.067
inflation	2.764436	7.325941	0.38	0.709
interest rate	22.29472	19.79659	-1.13	0.048
cons	2765.241	763.4113	3.62	0.001
No of observations	35			
F.Statistics	0.0369			
R.Square	0.4331			
Adjusted R.Square	0.2678			

Source: Data Analysis (2019).

CONCLUSION

The study concluded that the dynamics of price and government stabilization policies have effects on the supply of industrial fish in Nigeria. This is evidenced in the positive relationship between price and stabilization policy as shown by the findings.

RECOMMENDATIONS

It was recommended that policy that will regulate price, exchange rate, interest rate, agric credit be initiated to stimulate and provoke better supply of industrial fish in Nigeria.

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MARKETING OF OIL PALM FRUIT IN NDOKWA EAST LOCAL GOVERNMENT AREA OF DELTA STATE, NIGERIA

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ABSTRACT
The study examined the marketing of oil palm fruit in Ndokwa East Local Government Area, Delta State, Nigeria. Specifically, the study described the socio-economic characteristics of oil palm fruit marketers in the study area, identified the marketing channels, estimated the marketing margin at both wholesale and retail levels, and evaluated the profitability among the different categories of middlemen. A multistage sampling procedure was used to select 80 oil palm fruit marketers. Data obtained were analysed using descriptive statistics, marketing margin analysis, gross margin analysis and linear regression. Findings of the study showed that majority were females (61.25%) with a mean age of 41 years, they had primary (39%) and secondary (29%) school education and had a mean marketing experience of 6 years. The marketing channel was made up of different marketing chain comprising the farmers, wholesalers, processors, retailers and final consumers. Marketing margin was ₦55.50 and ₦54.40 at the wholesale and retail levels The components were transportation cost, storage cost, middlemen markup and market charges. Middlemen markup (47.57%) and storage cost (40.07%) accounted for the largest proportion of wholesalers and retailers' margin. The wholesalers and retailers incurred a total cost of ₦111.31 and ₦135.66 and also earned a total revenue of N137.50 and ₦149.50 respectively. A gross margin of ₦26.40 and ₦14.10 per kg as well as return on investment of ₦0.24 and ₦0.10 respectively indicate that oil palm fruit marketing was profitable both at wholesale and retail level. Middlemen markup, storage cost, market charges and transport cost had significant effect on the marketing margin indicating that an increase in each marketing cost would lead to a corresponding increase in marketing margin. The major constraint faced by the marketers was the problem of bad road network. It is recommended that young people should be encouraged to go into oil palm fruit marketing especially in the wholesale level considering the fact that it is a profitable venture.

Keywords: Oil palm fruit, Marketing, Edo State, Profitability, middlemen

INTRODUCTION
Oil Palm is a common name of an economically valuable palm tree, *Elaeis guineensis*, native of the west coast of Africa and widespread throughout the tropics, mostly seen in Nigeria, Ghana, Cote d'Ivoire and Sierra leone (Ofosu-Budu & Sarping, 2013). It is a common cash crop cultivated by farmers in Nigeria. Mature palms are single-stemmed and grow to 20 m tall. Established palms over 10 years produce about 20 leaves a year, the leaves are pinnate and reach 3-5 m long, the flowers are produced in dense clusters; each individual flower is small, with three sepals and three petals. The palm fruit takes 5–6 months to mature from pollination to maturity. It is reddish, about the size of a large plum, and grows in large bunches. Each fruit is made up of an oily, fleshy outer layer (the pericarp), with a single seed (the palm kernel), also rich in oil. When ripe, each bunch of fruit weighs between 10 and 40 kg depending on the age of the palm tree. Palm oil is extracted from the mesocarp of fruits of oil palm tree (Orji & Mbata, 2008). Other notable products from oil palm trees in Nigeria apart from Fresh Fruits Bunches of palm fruits includes palm-wine, brooms, storage baskets, and climbing ropes. The stems can be cut as wood for building (Onoja & Ogali, 2014).

By the beginning of the 20th century, Nigeria was a top exporter of palm oil and had a flourishing domestic trade in the world (Igiri *et al*.,2015). Between 1961 and 1965 world oil palm production was 1.5million tonnes, with Nigeria accounting for 43%, during the late 1900's world oil palm production amounted to 14.4 million tonnes, with Nigeria which used to be one of the largest producers in West Africa, accounting for only for 7% of its production (Kei *et al*., 1997). In rural areas, those who do not own processing mills face problems during the peak season when fruit is abundant and processors do not have storage for raw materials since the fruits are perishable and lose weight once harvested, farmers therefore need prompt evacuation and movement of their products to areas of need, hence the need of the efficient marketing of the products.

A well-developed market for agricultural produce provides access to consumers who depend on market for their food supply and farmers who shift from subsistent farming to commercial production. An increase in marketable crops calls for larger and improved marketing facilities. If marketing is efficient, farmers would allocate their resources according to their comparative advantages and intensify their production. Agricultural marketing assumes greater importance in the Nigeria economy because the wastage of harvested agricultural produce is reduced, products are available in areas where they are not planted, income is generated by farmers. Can this venture of marketing oil palm fruits ever become a lucrative and sustainable one seeing that the oil palm fruit in itself does not command much market attention as other farm products when in reality its usefulness is vast.

Knowing that inhabitants of Ndokwa East Local Government Area of Delta State are known for farming and have good soil for oil palm which is abundant in the area, what then is the state of marketing the oil palm fruits in the study area. Is it a profitable venture? What are the marketing channels of oil palm fruit in the study area? What is the marketing margin for oil palm fruit in the study area? What are the factors that influence the marketing margin in oil palm fruit marketing in the study area? What are the constraints faced by oil palm fruit marketers in the study area? The specific objectives were to: describe the socio-economic characteristics of oil palm fruit marketers in the study area; identify the marketing channels involved in the marketing of oil palm fruit in the study area; estimate the marketing margin of oil palm fruit in the study area; evaluate the profitability of oil palm fruit marketing among the different categories of middle men; identify the factors influencing the marketing margin of oil palm fruit marketing and identify the constraints faced by oil palm fruit marketers in the study area.

METHODOLOGY

This study was conducted in Ndokwa East Local Government of Delta State, Nigeria. The Ndokwa East Local Government was created in 1991 from the former Ndokwa Local Government Area, It is situated at about 150 kilometres from the commercial town of Asaba the headquarter of Delta State.

A multi-stage sampling procedure was used to select the respondents for the study. The first stage involved the random selection of four (4) communities in the Local Government Area. The second stage involved the purposive selection of one major market from each community giving a total of four markets. This was based on the level of oil palm fruit marketing in the market. The selected markets were Iselegu, Ashaka, Utagbo-uno, and Akarai markets. The third stage involved the simple random selection of all oil palm fruit marketers found in the selected markets. However, only about 27, 18, 20, 15 marketers were found in Iselegu, ashaka, utagbo-uno, and akarai markets respectively making a total of 80 marketers used for study.

The primary data were obtained through the use of a questionnaire and interview schedule which was done one-on-one with the marketers of oil palm fruits. The questionnaire was prepared in

English language, while the interview schedule with the respondents was done in their local language (Nkwani) and also in Pidgin English, using interpreters.

Data collected were analysed using descriptive statistics, Gross Margin, Profitability, Return on Investment and Benefit Cost ratio. The socio-economic characteristics of the oil palm fruit marketers were examined using descriptive statistics such as frequency counts, mean values and percentages. The marketing channel for oil palm fruit in the study area was described using a chart. Descriptive statistics and marketing margin analysis were employed in estimating the marketing margins.

Marketing Margin (MM) is given as:

MM = Selling price - Purchase Price ……..…….....…. (1)

(as cited in Alufohai and Izekor, 2020)

The profitability of the oil palm fruit marketing was analysed using gross margin analysis, net returns, return on investment and benefit cost ratio of cassava marketing.

Gross Margin = Total Revenue – Total Variable Cost ….……. (2)

Total Variable Cost = Total Cost – Total Fixed Cost

Net Profit = Gross Margin –Total Fixed Cost (depreciation) ……...….. (3)

Return on investment (ROI)=$\frac{\text{Net profit}}{\text{Total investment}}$ ..... (4)

Benefit Cost Ratio (BCR) = $\frac{\text{Present value of total benefits}}{\text{Present value of total costs}}$ …… (5)

$$\text{Benefit Cost Ratio (BCR)} = \frac{\sum_{t=1}^{n} \frac{Bt}{(1+r)^n}}{\sum_{t=1}^{n} \frac{Ct}{(1+r)^n}}$$

Where B_t is the total benefit in naira in the time period t; C_t is the total cost in naira in the time period t; r = interest rate; n = number of years. The values for this analysis were however not discounted as cross sectional data were used for the study. Therefore, the benefit cost ratio was calculated using:

$$\text{BCR} = \frac{\text{present value of total revenue}}{\text{present value of tatal cost}}$$

Decision Rule:

BCR > 1 - The business is viable; BCR = 1 - Break - Even point; BCR < 1 - The business is not viable (as cited in Emokaro and Erhabor, 2014)

The effect of the cost of marketing functions on the magnitude of the marketing margin in oil palm fruit marketing at the wholesale and retail levels was analysed using linear regression model.

The model for this analysis is given implicitly below as:

$Y= f(X_1, X_2, X_3, X_4)$ …… (6)

The explicit function is given as:

$Y=b + b_1X_1 +b_2X_2+ b_3X_3 + b_4X_4 +e$ (as cited in Effiong and Konye, 2013)

Where Y= Estimated marketing margin

X_1=Transportation cost

X_2=Storage cost

X_3=Market charges

X_4= Middle men profit

b_1 - b_2 = Coefficients to be estimated

e = error term

Test of significance were done using the F and t-tests

The constraints faced by Oil Palm Fruit marketers were ranked using A 3-Point Likert type of scale [very serious, serious, and not serious] with the very serious constraints being assigned the highest score (3), the not serious assigned (1). The mean value of 2 was used as benchmark such that any score above or equal to 2 was regarded as serious.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Oil palm Marketers

Table 1: Distribution of Respondents based on their Socio-Economic Characteristics

Socio-Economic Characteristic	Frequency (80)	Percentage (%)	Mean	
Sex				
Male	31	39		
Female	49	61		
Total	80	100.00		
Age(Years)				
18 – 25	12	15		
26 – 35	21	26		
36 – 45	26	33	41	
55 – 65	6	8		
Total	80	100		
Marital Status				
Single	16	20		
Divorce	3	4		
married	56	70		
Widow	5	6		
Total	80	100		
Household size(Number)				
1 – 3	12	15		
4 – 6	25	31		
7 – 9	31	39	8.0	
10 – 13	12	15		
Total	80	100		
Educational qualification				
No formal education	25	31		
Primary school	31	39		
Secondary school	23	29		
Tertiary	1	1		
Total	80	100		
Years of marketing experience(Years)				
1 – 10	51	58		6
11 – 20	20	29		
21 – 30	9	14		
Total	80	100		

Source: Field Survey, 2018

The socioeconomic characteristics of oil palm fruit marketer is presented on Table 1. The result in Table 1 shows that majority of the marketers (61%) were females. This is in consonance with Gaya Okungbowa et al., 2013 with the finding that majority of palm oil marketer in Ethiope East Local

Government Area of Delta state are females The highest percentage of marketers fell between the age bracket of 36- 45 years (33%), with mean age of 41 years. This shows that relatively young people were more involved in marketing of oil palm fruit. This finding is in conformity with that of Adesiji *et al*. (2016) with the findings that producers and marketers of oil palm were fairly young with mean age of 43 years in Kogi State, Nigeria. The result also showed that most of the respondents (70%) of the respondents were married with a mean household size of 8. It was also observed that majority of the respondents had primary (39%) or secondary (29%) school education, although 31% of respondents had no formal education. This indicates that the respondents were fairly educated. Majority (58%) of the respondents had less than 10 years of experience in oil palm fruit marketing with mean marketing experience of 6 years. This implies that most of the oil palm fruit marketers were quite acquainted with the business and fairly experienced.

Table 2: Marketers Category for Oil Palm Fruit marketing in Ndokwa East Local

Marketers Category		**Frequency(80)**	**Percentage(100)**
Category of sellers	Wholesalers	57	71.25
	Retailers	23	28.75
Source of supply	Farmers	48	60.0
	Wholesalers	18	22.50
	Personal	14	17.50
Category of buyers	Final consumer	19	23.75
	Retailer	40	50.00
	Processor	21	26.25
Total		**80**	**100.00**

Computed from Field Survey Data, 2018

The marketing channel identified for oil palm fruit in the study area is depicted by figure 1. It showed that oil palm fruits moved through different marketing chain, comprising the farmers, wholesalers, retailers, processors and final consumers. This conforms to the marketing channel observed for Palm Kernel in Ovia North East Local Government Area of Edo State (Okere *et al*., 2016)

Furthermore, the result in table 2 showed that 60% of the respondents had their supply from oil palm farmers, 23% had theirs from wholesalers, while 18% of the respondents got theirs from their personal farms. This indicates that most of the farmers were not directly involved in the marketing of oil palm fruits after harvest. This is however not in line with the findings of Onoja and Ogali, (2014) with the finding that about 42% of the sampled marketers in Kogi State obtained FFB from their own farm. It is also observed that 71% of the respondents were wholesalers and 29% were retailers.

It also showed that 24% of the respondents sold to final consumers, 50% sold to retailers, 26% sold to processors. This shows that most of the oil palm fruit marketers in the study area were wholesalers selling mostly to the retailers and processors.

Marketing Channels of oil palm fruits in the study area

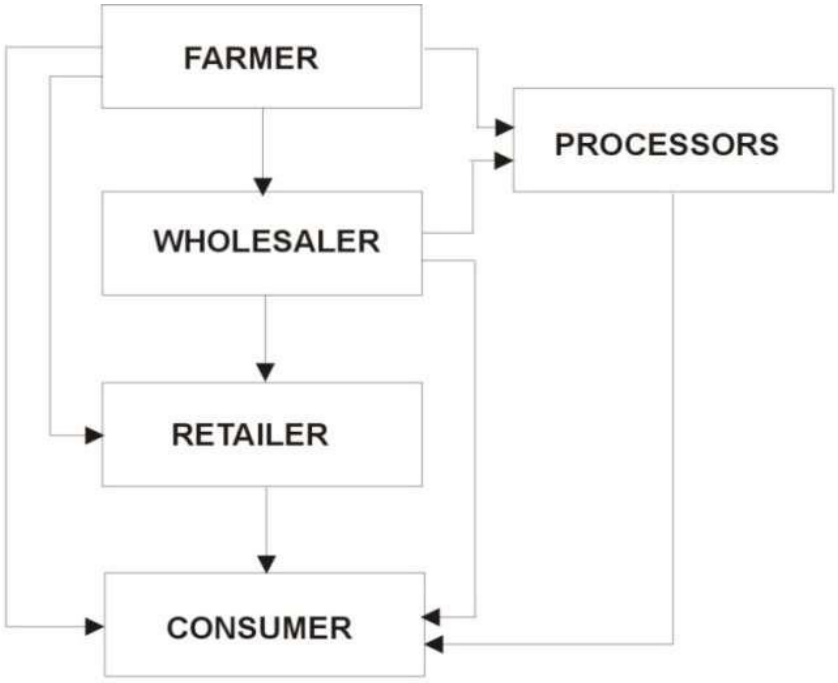

Figure 1: Marketing channels for oil palm fruit in the study area.

Marketing Margin of oil palm fruit marketers

Table 3: Average size of the marketing margin (per kg of oil palm fruit)

Variable	Wholesaler (₦/kg)	Retailer (₦/kg)
Selling price	137.50	149.50
Purchase price	82.00	95.10
Marketing margin	**55.5**	**54.4**

Computed from Field Survey Data, 2018

Table 4: Identified components of the Marketing Margin (per kg of oil palm fruit)

Component	Wholesaler (₦/kg)	Percentage (%)	Retailer (₦/kg)	Percentage (%)
Transport cost	4.80	8.65	9.00	16.55
Storage cost	21.40	38.55	21.80	40.07
Market charges	2.90	5.23	9.50	17.46
Middlemen markup	26.40	47.57	14.10	25.92
Total margin	55.50	100.00	54.40	100.00

Computed from Field Survey Data, 2018

The result of the marketing margin analysis is presented in Table 3, the average marketing margin was ₦55.50 per kg for the wholesalers and ₦54.40 per kg for the retailers. Further analysis on the breakdown of the marketing margin presented in table 4 showed that the component of the

marketing margin included transportation cost, storage cost, market charges and middlemen mark-up.

For the wholesaler, the middlemen markup accounted for about 47.57% of the marketing margin while transportation cost, storage cost, and market charges accounted for the remaining 52.43% of the wholesalers margin while for the retailers margin, the storage cost (40.07%) accounted for the highest cost of the marketing margin, while transport, market charges and middlemen markup accounted for the remaining 59.93% of the retailers margin.

Profitability Analysis of oil palm fruit marketing

Table 5: Profitability Analysis of oil palm fruit marketers in the study area

Item	Wholesaler(₦/kg)	Retailer (₦/kg)	Pooled (₦/kg)
Variable cost			
Transport cost	4.8	9.0	6.90
Purchase cost	82.0	95.0	88.50
Market charges	2.9	9.6	6.25
Storage cost	21.4	21.8	21.60
Total variable cost	**111.1**	**135.4**	**123.25**
Fixed cost			
Buckets and baskets	0.21	0.26	0.24
Total fixed cost	**0.21**	**0.26**	**0.24**
Total cost	**111.31**	**135.66**	**123.49**
Revenue	**137.5**	**149.5**	**143.5**
Gross margin	**26.4**	**14.1**	**20.25**
Net income/profit	**26.19**	**13.84**	**20.02**
Benefit cost ratio	**1.24**	**1.10**	**1.17**
Return on investment	**0.24**	**0.10**	**0.16**

Computed from Field Survey Data, 2018

The result of the profitability analysis is presented in Table 5. The result showed that purchasing cost (73.80%) accounted for the largest percentage of the cost incurred by wholesalers with total variable cost of ₦111.10 The marketers earned an average total revenue of ₦137.50. This gave a net profit of ₦26.19 per kg, indicating that oil palm fruit marketing is a profitable in the study area. This was also confirmed by a return of investment of 0.24 which means that the wholesaler would earn 24kobo for every ₦1 invested. Similarly, the retailer's incurred an average total variable cost of ₦135.4, the bulk of which was spent as purchasing cost (70.16%). The retailers earned an average total revenue of ₦149.5 giving a net profit of ₦13.84 per kg, also indicating that oil palm fruit marketing in the retailer level is a profitable in the study area. This was also confirmed by a return of investment of 0.10 indicating the retailer earned 10kobo for every ₦1 invested. This result shows that marketing of oil palm fruit is more profitable at the wholesale level than at the retail level in the study area. This finding is similar to that of Ojo *et al*. (2014), that palm oil marketing is profitable business in Kogi state, Nigeria.

Effect of Marketing Cost on Magnitude of Marketing Margin

Table 6: Linear Regression Result for Wholesaler

Variables	Coefficient	t-value
Middlemen Profit	0.87	0.55*
Storage cost	0.05	0.93*
Market charges	0.03	0.30*

Transport charges	0.50	0.75*
R^2	0.96	
F-Value	6.32	
STANDARD ERROR	0.29	

*significant at 5% **Computed from Field Survey Data, 2018**

Table 7: Linear Regression Result for Retailer

Variables	Coefficient	t-value
Middlemen Profit	0.87	0.97*
Storage cost	0.26	0.30*
Market charges	0.30	0.91*
Transport charges	0.37	0.16*
R^2	0.89	
F-Value	6.05	
Standard error	0.32	

Computed from Field Survey Data, 2018; *significant at 5%

Results presented in Table 6 and 7 show the contributions of the various components of the marketing margin to its magnitude for wholesalers and retailers. The result showed that the components of the marketing margin (transportation, storage costs, market charges middlemen's mark-up) explained about 96% and 89% of the variations in the magnitude of marketing margin for the wholesalers and retailers respectively. Middlemen profit, storage cost, market charges and transport cost had positive significant effect on the marketing margin of oil palm fruit marketers, both at the wholesale and retail level. This implies that for every increase in cost of these marketing functions, there would be a corresponding increase in the marketing margin.

Constraints to Oil Palm Fruit Marketing in the Study Area

TABLE 8: Marketing Constraints

Variables	Mean
Bad road network	2.55*
Price variation at the market	1.31
High transport cost	1.24
Risk of spoilage	0.19
Too many sellers	0.11
Poor demand	0.08
Low market price	0.04

Computed from Field Survey Data, 2018; *very serious (mean>2.0)

The constraints faced by oil palm fruit marketer in the study area are presented in Table 8. The result showed that bad road network is the major constraint affecting oil palm fruit marketing with a mean of 2.55. The other constraints were considered less serious by the respondents in the study area. This corrobates the findings of Ayawari, *et al*., (2017) that transportation cost was the most serious constraint affecting palm oil marketers in South-south states of Nigeria and attributed it to bad road network.

CONCLUSION

The study established that oil palm moved through different marketing chain comprising the farmers, wholesaler, retailers, processor and final consumers. Middlemen markup accounted for the largest proportion of the marketing margin of the wholesaler while storage cost accounted for the largest proportion of the retailers with the middlemen markup and storage cost identified to

have positive and significant effect on the marketing margins of both the wholesalers and retailers. The result showed that oil palm marketing is a profitable venture in the study area with the wholesalers earning a higher return than the retailers.

RECOMMENDATIONS

It is therefore recommended that:

i. Marketers should operate at the wholesale level in order to earner higher profit.
ii. Due to the problem of bad roads government should give urgent attention to the improvement of roads from rural to urban areas for easy access, and thus reduce cost of transportation which may reduce the market margin and probably reduce the financial burden on final consumers.
iii. The marketers should come together to form a cooperative as a means to own their own store houses in order to reduce the cost of storage which may reduce the margin as storage cost was observed to be the major component of the margin of the retailers.
iv. Being a profitable venture, young people should be encouraged to go into oil palm fruit marketing in a larger way as it is a good source of livelihood.

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LEVEL OF WOMEN CASSAVA PROCESSORS INVOLVEMENT IN CASSAVA PRODUCTION VALUE CHAIN ACTIVITIES IN OVIA NORTH EAST AND UHUNWONDE LOCAL GOVERNMENT AREA OF EDO STATE, NIGERIA

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ABSTRACT
This study assessed the level of involvement of women processors in cassava production value chain activities in Ovia North East and Uhunwonde Local Government Areas. Specifically, the study examined socio-economic characteristics, ascertain the available, accessible and preferred information source, constraints and level of involvement in cassava value chain by women cassava processors. Multistage sampling was used to select 116 respondents. Data collected with the use of a structured questionnaire were analysed using descriptive statistics such as frequency counts, percentage and inferential statistics such as logit regression and t-test. Results showed that 47.4% of respondents were between the ages of 41 to 51 years and 86.2% were married, 51.7% had household size of less than 5 persons with a mean farm size of 3.9 hectares. Results also showed that respondents mostly get information from friends and family (98.3%) while poor infrastructure (M=3.22) was a major constraint. The study also revealed that, there was high level of women involvement in cassava production value chain activities except for tapioca and high quality cassava flour write in full. More so, farm size and monthly income influenced women involvement in cassava production value chain activities. The study concluded that women processors involved in cassava production value chain are highly in need of information to increase their income. It is recommended that stakeholders should create an effective linkage mechanism between the farmers, processors and marketers and also make extension workers available and accessible to provide necessary assistance.

Keyword*: Involvement, women processors, cassava production, value chain activities*

INTRODUCTION
Cassava (*Manihot esculenta*) has remained one of the most important root crop widely cultivated, traded and consumed in sub-Saharan Africa including Nigeria. Nigeria is the largest cassava producer in the world, producing one - third more than Brazil and almost the double production capacity of Thailand and Indonesia (Nigeria Cassava Master Plan, 2006). Production of this crop has remained in the hands of small-scale farmers who have taken advantage of its unique characteristics such as; drought tolerant, can be grown with other crops, can successfully be stored in the ground/soil for many months, and is highly marketed in tubers, granulated roasted (garri), in fermented pasta (fufu) and as cassava flours which guarantee food security and income. Cassava is a perennial crop that is drought tolerant, requires minimum input, and has an extended harvesting period. Cassava also contains a high starch content and is a cheap and rich source of dietary energy, with an energy yield per hectare estimated to be considerably higher than that of cereals (Howeler et al., 2013). In recent times cassava is progressively gaining a strategic position in the global trade as a result of the efforts by various research and development stakeholders in developing value-added cassava-based products for human consumption and industrial uses (Onyeka, Dixon & Ekpo, 2005). The value chain and utilization of the crop has therefore been given prime attention by government and other stakeholders. In

Nigeria, an estimated 90% of cassava produced is processed into food. Seventy percent of the cassava processed into food is turned into garri, a product achieved when cassava is fermented, dried, and ground. The remaining cassava processed into food takes the form of elubo or lafun, fufu, or abacha. There is high industrial demand for cassava, mainly as a local and cheaper replacement for imported raw materials and semi-finished products. Locally there is a particular demand for high-quality cassava flour (HQCF). It currently accounts for 10% of Nigeria's industrial market and is used as a replacement in bread flour, biscuits, and confectioneries, adhesives, seasonings, and hydrolysates for pharmaceutical products. Another industrial use is in the production of native and modified starches (Otekunrin & Sawicka, 2019).

Cassava is linked with women because of its important role in household food security, which is often the responsibility of women. Though men are traditionally more involved in cash-crop activities, which gives them the advantage of higher income (Sell & Minot, 2018), the cassava value chain in Nigeria is primarily built upon the labor of women for both farm-level production and value addition. Practically, the low-risk and low-input requirements of cassava are particularly important for women who experience more severe constraints in accessing agricultural inputs in comparison to men, and face more constraints in participating in alternative markets such as cash crops (Kiriti & Tisdell, 2003). For these reasons it is often assumed that new opportunities in cassava value chain could increase women income, which would most likely be spent on education and health, contributing to a number of development indicators. The value chain of a product describes the full range of activities which are required to bring a product or services from conception, through the different actors involve in the production, processing, and delivery to the final consumers (Adekunle et al. 2012).

Cassava value chain development approach must embrace gender participation to ensure that men and women in competition are 'equally involved' in meeting challenges of growth and development of the farm commodity, its involvement in creation of more jobs, and removal of distortions, and discriminations in labour markets, this aptly applies to a choice crop like cassava where harvest and post-harvest value chain elements require gender decisions to reduce inefficiencies and improve profit. Agriculture is underperforming in Nigeria for several reasons. One of the leading causes for this is the fact that women are often cut off both socially and legally from resources, the means of production, and opportunities that are typically afforded to men. However, women in Nigeria still provide a large amount of agricultural labor, women participate in agricultural activity as self employed farmers, as unpaid workers on family farms and as paid or unpaid laborers on other farms and agrarian organizations (FAO, 2011). The contribution of women to agricultural production over the years has been belittled and there is a need to make available to them appropriate information to enhance their level of involvement and productivity (Okwu & Umoru, 2009). However, much studies have been carried out in the area of information needs of women cassava farmers. Omoregbee and Banmeke (2014) worked on information needs of cassava farmers in delta state of Nigeria, Kehinde and Sabuola (2015) Studied women and cassava processing in Nigeria. while only very few studies have worked on women cassava processors level of involvement in cassava value chain addition in Ovia North East and Uhunwonde Local Government Area.

In pursuing this line of reasoning therefore, the specific objectives of this study are, to: describe socio-economic characteristics of women cassava processors; ascertain available, accessible and preferred information source; ascertain respondents' level of involvement in cassava value chain and identify the constraints encountered by respondents in cassava value chain in study areas.

METHODOLOGY

The study was conducted in Ovia North East and Uhunwonde Local Government Area of Edo state, Nigeria. Edo state is an agrarian state with oil palm, cassava, rubber, rice, maize, cocoa, plantain, pineapple, as major crops cultivated. Uhunwonde has its headquarters in the town of Ehor and has an area of 2,033km^2 and population of 120,813(NPC 2006). The agricultural system is predominantly small farm holdings. Ovia North East has its headquarters in okada and has an area of 2,301km^2 with a population density of 121 people per square kilometers (Edo ADP, 2007). This area is characterized by a tropical climate that ranges from humid to sub-humid at different times of the year with two different seasons average temperature ranging from a minimum of 24^o C to a maximum of 33^{o}C. The population of this study will consist of cassava women processors in Ovia North East and Uhunwonde Local Government Area in Edo State. Multistage sampling technique was employed. First stage involved, a purposive selection sampling technique of Ovia North-East and Uhunwonde Local Government Areas based on the intensity of cassava production when compared with other areas in the state. At the community level, a list of women who doubles as cassava farmers and processors was generated in each of the LGAs where 112 and 148 processors were listed in both LGAs respectively. Thus, a total of 260 women were listed. Secondly, a proportionate sampling technique was used to select 50% of the 260 women to give a total of 116 for the study.

Data collected were described using mean, frequency count and percentages while logit regression and t-test were used to make inference.

The logit regression is given is given as:

$$Pr(Y=1/X_I) = Ln\left[\frac{Yi}{1-Yi}\right] = a + biXi + \ldots\ldots + b_nX_n + U \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where:

L_n = Natural log

$Pr(Y=1/X_i)$ = Probability of Y (level of involvement) occurring, given that X_1-X_n have occurred

a = The coefficient of the constant term

b_i-b_n = The coefficient of the independent variables (age, sex, household size)

Xi-Xn = The independent variable

U = Error term

The mathematical expression of the model is explicitly specified as:

$$Y_i=b_o+biX_i+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7+b_8X_8+b_9X_9+ U\ldots\ldots\ldots..(2)$$

Where,

Yi = levels of involvement in value chain activities (high=1, low=0)

$\bar{x}_1$ = Age (number of years)

$\bar{x}_2$ = Household size (number of persons living and feeding from same pot)

$\bar{x}_3$ = Education (primary education=1, secondary education=2, tertiary education=3)

$\bar{x}_4$ = Processing experience(years)

$\bar{x}_5$ = Farm size (hectares)

$\bar{x}_6$ = Source of Labour (self = 1, family labour= 2, hired labour= 3)

U = Error term

Ho1: There is no significant difference between women cassava farmer's constraints in Ovia North East and Uhunwonde Local Government Area of Edo State. This was measured using t-test as shown below:

$$t=\frac{\bar{x}_1-\bar{x}_2}{\sqrt{\frac{{S_1}^2}{N_1}+\frac{{S_2}^2}{N_2}}}$$

$\bar{x}$ = Mean of women cassava processors constraints in Ovia North East Local Government Area

$\bar{x}$ = Mean of women cassava processors constraints in Uhunwonde Local Government Area

S^2 = Variance

N = Number of observations

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents

Table 1: Socio-economic characteristics of respondents

Variable	F	%	Mean	Std. Dev
Age (in years)				
<= 30.00	12	10.3		
31.00 - 40.00	38	32.8	41.03	7.72
41.00 - 50.00	55	47.4		
51.00+	11	9.5		
Marital Status				
Married	100	86.2		
Single	13	11.2		
Widowed	3	2.6		
Household size (No. of pers.)				
<= 5.00	60	51.7		
6.00+	56	48.3	5.11	1.82
Religion				
Christianity	103	88.8		
Islam	12	11.2		
Traditional worshippers				
Education	70	60.3		
Secondary education	43	37.1		
Tertiary education	3	2.6		
Farming of experience (years)				
<= 10.00	54	46.6		
11.00 - 20.00	42	36.2	13.42	8.04
21.00+	19	17.3		
Cassava farm size (Ha)				
<= 5.00	59	50.9		
5.01+	18	15.5	3.90	2.63
Source of labour				

Self	17	15		
Family labour	53	46		
Hired labour	46	40		
Monthly Income				
<= 18000.00	108	93.1		
₦18001.00 - ₦40000.00	6	5.1	₦29,956.52	₦8,626.91
62001.00+	2	1.8		

Source: Field survey, 2019.

The results presented in Table 1 indicated that the respondents were within the age of 41-50 years with a mean age of 41 years. This implies that the women belong to the production population category which is 25-59 years. This aligned with the study conducted on women involved in cassava production by (Okwu & Umoru, 2009). Majority of the respondents were married (86.2%) with household size of more than 5 persons, above average (60.3%) had primary education while only 37.1% had secondary education and 46.6% of the respondents have more than 10 years of farming experience. This implies that their household size is relatively low compare to the tedious nature of the work involved in cassava processing and this may discourage them to further continue except they hire more labourers which would significantly add to the cost of production. Their level of education. With regards to level of education, respondents had at least basic education to understand some technical areas in cassava value addition. Basic literacy level is required to understand the use of improved technologies (Eze & Nwibo 2014). Their years of processing experience implies that they are expected to be knowledgeable about cassava value chain addition and if the processors are properly supported with all their information needs, they will do well in their production and still be able to tell the difference from their years of experience.

With respect to source of labour, about half (46%) of the respondents were engaged in the use of family labour. The high use of family labour may be due to the fact that most respondents are engaged in small scale production of cassava products. Furthermore, results showed that almost all (93.1%) of the respondents had monthly income from sales of cassava value chain addition products of less than ₦18,000 while 5.1% had monthly income of between ₦18,000 and ₦40,000 while 1.8% had monthly income of ₦62,000 and above with a mean of ₦30,000 monthly. This implies that cassava value chain ventures are seen as not lucrative. This low income could be as a result of lack of necessary marketing information. This agrees with the findings of Akinbile and Ndaghu (2005) that low income from cassava production might threaten continued participation of farmers in cassava value chain. However, increase in income would enable poor households save more financial resources and consequently gain required financial ability to invest in new technologies that are needed for large scale production (Okello, 2005)

Sources of Information Available, Accessible and Preferred in Cassava Value Chain

The result in Table 2 showed that almost all the women source information from friends and family (98.3%), Broadcast from Radio (87.9%), Broadcast from TV (82.8%) and Cassava millers (69%) while only 1.7% of women processors get information from Academic researchers and Newspapers. This result agrees with the findings of Yahaya (2001) that women farmers usually get agricultural information on improved technologies from their husbands and fellow women. It was further observed that 4 out of 9 information sources were accessible which are information from friends and family(M=3.79), Broadcast from Radio (M=3.21) followed by Broadcast from television(M=3.06) and Cassava millers(M=3.06) while out of 9 information sources, only 5

were preferred which include friends and family(M=3.59), Broadcast from Television (M=3.51), Broadcast from Radio(M=3.43).

Table 2: Results of information available, accessible and preferred in cassava valve chain

	Availability		Accessibility		Preference	
Information sources	**F**	**%**	Mean	Std. Dev	Mean	Std. Dev
Extension agents	9	7.8	1.76	0.89	3.31*	0.97
Broadcast from Radio	102	87.9	3.21*	0.97	3.43*	0.56
Broadcast from television	96	82.8	3.06*	0.83	3.51*	0.72
News papers	2	1.7	1.51	0.97	1.44	0.79
Friends and family	114	98.3	3.79*	0.52	3.59*	0.67
State Min. of Agric.	7	6	1.57	0.80	2.29	0.78
Internet	2	1.7	1.52	0.76	1.48	0.74
Cassava millers	80	69	3.06*	0.83	2.54*	0.97
Research Centres	2	1.7	1.43	0.90	1.43	0.68

Source: Field survey, 2019.*Mean ≥ 2.5 = accessible and most preferred.

This results confirms the findings of Banmeke and Olowu (2005) that the rise in farmers preferring fellow farmers as a first hand source of information may be due to the apparent ineffectiveness in public extension service in developing countries and that fellow farmers have better practice and experience. Only 7.8% indicated that extension workers were available but are not accessible when the need for information on cassava value chain addition arises. Meanwhile they are one of the preferred information sources by respondents. This is an indication that the women understand the relevance of extension workers in cassava value chain addition.

Constraints Encountered by Women Processors Involved in Cassava Value Chain

The results in Table 3 showed that 10 out of 19 possible areas of constraints were considered serious by respondents using a mean score of 2.5 and above as a benchmark for this study. The Major constraints are Poor infrastructure (M=3.22), Unavailability of extension agents to properly guide the use of information (M=3.21), Inability to read or write (M=3.04), Weak Radio and television signal (M=3.04). This implies that effort adequately tackling these constraints should be taken so as to enhance their interest and investments in cassava value chain. This tallies with the report of Asante-Pok (2013), Omoregbee and Banmeke (2014) who noted that the constraints in cassava production include a wide range of technical, governmental and socioeconomic factors.

Table 3: Constraints encountered by women processors involved in cassava value chain

Cassava Value Chain Constraints		
production constraints	Mean	Std. Dev
High cost of fertilizers, herbicides and insecticides	2.62*	1.06
No access to credit facilities	2.58*	0.95
High cost of weed control	2.98*	1.02
High incidence of pest and disease	1.92	0.70
Shortage/high cost of labour	2.52*	0.76
processing constraint		

High cost of processing equipment	2.96*	0.98
Deterioration of cassava tubers	1.88	1.00
Poor infrastructure(water, roads and electricity)	3.22*	1.02
Bulkiness of cassava tubers	1.71	0.91
Disposal of cassava peels	1.36	0.80
marketing constraints		
High cost of transportation	2.96*	0.98
Opportunities and access to foreign markets	1.57	0.75
Poor quality of local products	1.75	0.91
Price fluctuations of cassava products	1.59	0.65
Too many middlemen	2.38	1.04
information constraints		
Weak Radio and Television signal	3.04*	0.82
Inability to read or write	3.04*	0.82
Concerns arising from uncertainties when information is used	2.92*	0.98
Unavailability of extension agents to properly guide the use of information	3.21*	1.00

Source: Field survey, 2019.*Mean ≥ 2.5 = Serious

Women Cassava Processors Level of Involvement in Cassava Value Chain Addition

The results presented in Table 4 showed cassava women had high level of involvement on value chain activities ranging from production, processing, marketing and value addition activities based on their percentages except in the area of HQCF and Tapioca. Furthermore, the result on marketing of cassava value chain addition products showed women high involvement in all marketing activities. This perhaps is because in Nigeria, cassava is a household food especially in the form of Garri, Lafun and Fufu. Hence, information that will boost production and value chain addition would really be utilized by the women processors. The results agree with the reports of IFAD (1994) which noted that women play a dominant role in the marketing of cassava.

Table 4: Women Cassava Processors involvement in cassava value chain

Cassava value chain	**Involvement**	
production activities	**F**	**%**
Planting	63	54.3
Fertilizer application	87	75
Weeding	77	66.4
Harvesting	71	61.2
processing activities		
Transportation of tubers to the house	85	73.3
Peeling of tubers	99	85.3
Washing of peeled tubers	99	85.3
Drying	24	20.7
Milling	13	11.2
Sieving	59	50.9

Frying	68	58.6
Packaging	113	97.4
marketing activities		
Transportation of products to the market	105	90.5
Loading / unloading	77	66.4
Grading	104	89.7
value addition activities		
African Salad/Abacha	17	14.6
Garri production	89	76.7
Fufu production	43	37.1
Lafun production	24	20.7
Starch production	62	53.4
Cassava Slice	6	5.1
Tapioca	-	-
HQCF	-	-

Source: Field survey, 2019.

Table 5: Significant difference between respondents constraints in Ovia North East and Uhunwonde Local Government Area of Edo State.

Results in Table 5 shows that a statistical significant difference exist in constraints faced by women farmers in Ovia North East (Mean=57.93) and Uhunwonde (Mean=50.33) LGA of Edo state. The mean difference was 7.6 with a t-test value of 5.54 at 0.01 level of significance. The null hypothesis was therefore rejected. This difference may be attributed to the earlier results obtained which showed that women processors in Ovia North East Local Government area need more information in their farming activities than their counterpart.

Table 5: Results of independent t-test showing significant difference in women cassava processors's constraints in Ovia North East and Uhunwonde Local Government Area.

LGA	N	Mean	Std. Deviation	F	Sig	t	df	Sig
Ovia NE	71	57.93	7.89	0.07	0.80	5.54**	114	0.00
Uhnwode	45	50.33	5.95					

Source: Field survey, 2019 **Sig at 0.01 significant level

Table 6: Relationship between socio economic characteristics of women processors and level of involvement in cassava value chain.

The result in Table 6 using logit regression model shows that among the socio-economic characteristics regressed on level of involvement in cassava value chain, farm size(t=4.16) and monthly income were statistically significant at P (0.01). This therefore implies that as farm size increases, women processors level of involvement in cassava value chain addition also tends to increase. Also, as their monthly income increases, their level of involvement in cassava value chain also increases. The value of coefficient of multiple determination (R^2) was 0.197 which implied that 19% of the variations in the level of involvement of the women cassava processor can be explained by the significant explanatory variables (farm size and monthly income). The likelihood ratio which is 85.802 is relatively high which shows the fitness of the model.

Table 6: Results of the binary logit regression showing the relationship between the socio-economic characteristics of women processors and their level of involvement in cassava value chain activities.

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-0.03	0.06	0.30	1.00	0.58	0.97
Marital status	1.61	1.39	1.35	1.00	0.25	5.00
Household size	-0.08	0.20	0.17	1.00	0.68	0.92
Education	-0.43	0.55	0.61	1.00	0.43	0.65
Years of experience	-0.09	0.04	5.29	1.00	0.00	0.91
Cassava farm size	0.30	0.15	4.16	1.00	0.05*	1.11
Labour source	-0.06	0.49	0.02	1.00	0.90	0.94
Monthly income	.2.17	.0.94	5.41	1.00	0.01**	0.51
Constant	1.39	2.84	0.24	1.00	0.63	4.00

Source: Field survey, 2019.*0.05% significant level 0.01% significant level-2 Log likelihood = 85.802; Nagelkerke R Square = 0.197**

CONCLUSION

The study established that information from friends and family are mostly accessible and preferred by respondents. The women were highly involved in almost all level of cassava value chain addition. However, the women cassava farmers faced several constraints especially on poor infrastructure (roads, electricity and water). Although, there was no significant difference between the constraints faced by women processors in Ovia North East and Uhunwonde LGAs. Also, farm size and monthly income were statistically significant to women cassava processors' level of involvement.

RECOMMENDATIONS

The study recommends that stakeholders should, create an effective linkage mechanism between the farmers, processors and marketers perhaps this will increase their income and also make extension workers available and accessible to provide necessary assistance.

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ASSESSMENT OF THE PERFORMANCE AND STRUCTURE OF RETAIL RICE MARKET IN ENUGU STATE, NIGERIA

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ABSTRACT
The study assessed the performance of retail rice marketers and the structure of retail rice market in Enugu State Nigeria. It specifically analyzed the socioeconomic characteristics of the rice farmers, the marketing performance of the rice marketers and the structure of the rice market. Multistage sampling technique was used to select 80 retail rice marketers from the three agricultural zones of the State. Data collected were analyzed using descriptive statistics, marketing performance indices and gini coefficient. The result showed that retail rice marketing in the area is majorly a female enterprise. Most of the marketers were married and still in their productive age. A marketing efficiency of 55.94% and net margin ₦3077.23 showed that retail rice marketing in the area is fairly efficient and profitable. A gini coefficient value of 0.15 indicated that income among the rice marketers was fairly equitably distributed. The study recommended the provision of inputs and infrastructure to reduce the cost of rice from source.

Key words: Rice, Retail, Market, Gini Coefficient

INTRODUCTION
Agriculture is the mainstay of many economics and it is fundamental to the socio-economic development. It is the most important enterprise in the world being also the oldest. Agriculture is what majority of humans practice as a profession. Over 50% of the population of the world practice agriculture or are dependent on it for a living; it includes farming, fishing, animal husbandry and forestry. Before the oil boom in Nigeria, the agricultural sector was the largest sector in the Nigerian economy with its dormant share of the Gross Domestic Product (GDP), employment of more than 70% of the active labour force and the generation of about 88% of non-oil foreign exchange earnings (Oji-Okoro 2011, Udemezue, 2019 & Ufiobor, 2017). Despite these however, the sector is still characterized by low yields, low level of inputs and limited areas under cultivation (Ufiobor, 2017; Ekundayo & Olupitan, 2016).

The greatest challenge to the agricultural production in Nigeria is how to ensure increased food production and value addition of agricultural products (Udemezue, 2019). Agricultural Development focuses on credit and non -credit users to create a more effective, transformational approach that achieves poverty reduction and hunger alleviation for all, and also improves productivity between credit and non –credit users. (World Food programme, 2009). The major agricultural products were cassava, corn, rice, millet, cocoa, groundnut, palm oil, rubber, sorghum, yam, and livestock (Aminu & Anono,2012). Today, rice is the most important staple food and the most common cereal food crop in Nigeria(Osabuohien. Okorie &Osabohien, 2018; Mohammed, Ibrahim, Hayatu &Mohammed, 2019).It is the main source of food energy and an important source of protein providing substantial amounts of the recommended nutrient uptake of zinc and niacin. Rice consumption has risen tremendously since 1970 (10.3 per cent per annum), as result of the accelerating population growth rate (2.8 per cent per annum) and increasing per capita consumption (7.3 per cent per annum) leading to an increase in domestic demand over domestic supply.

Considering the importance of rice to man and in national development, the Nigerian government as well as individuals have made several attempts to increase commercial rice enterprise but their efforts have been beset with a lot of constraints, such as infrastructural and marketing problems and very high and rising costs of labour and equipment. Thus, a progressive and chronologically receptive marketing system can help promote economic growth since increasing the marketability of rice will stimulate production. So, the ever-increasing demand for rice products makes the marketing of rice a significant area to investigate. Therefore, the marketing of any commodity is a specialized technique and demands proper organization. Care (2004) described marketing as a machine that directs production along the line most suited to the consumer requirement. Thus, production is limited by the extent of marketing. Where the local markets are too small to absorb the increased output of the farmers and the prospects for moving the local gluts to areas of scarcity are poor, then the producer incentives to production are likely to be dampened. Where the local market with poor absorptive capacity is the only outlet, the farmers will be constrained to make their production decision or plan with the local market in view. Ikisan (2004) highlighted the contributions of agriculture and food marketing towards an attempt to improve rural income in developing countries. According to him, the inequality of income between the rural and urban areas draws people away from agricultural production and places greater stress upon the infrastructure and social services of a country's towns and cities. Mame (2006) also asserted that a guaranteed market for farmer's produce was a ready invitation to produce more.

The demand for rice in Nigeria is growing at a faster rate than domestic supply. The domestic supply is 3 million metric tons per annum, while the demand is 5 million metric tons per annum. This leaves a wide gap of 2 million metric tons which is the highest in Africa (FAO, 2002). In order to make up for the inadequacy in domestic supply of rice, imports have increased steadily accounting for up to 60 percent of the total supply, a situation which has continued to drain the country's foreign exchange (Momoh, 2007). This has led to increased poverty, declining growth and competitiveness. It has also led to decrease in domestic production of rice and over dependence on rice importation. Central to the issue of inadequate domestic supply of rice is the problem of efficiency of agricultural marketing system. Inadequate marketing of agricultural produce has been one major problem limiting agricultural expansion (Care, 2004).

Rice farmers and domestic traders are constrained by a number of factors such as infrastructural and market facilities, costs of equipment, price differentials and the structure of the market.
Most of our roads, especially the rural roads where these foods are produced are not accessible and communication network is inadequate, making it more expensive for the food to reach the market. Market facilities such as transportation, already existing market, warehousing are factors that are likely to influence the efficiency of the marketing system. This is because without a niche market, farmers will not produce crops (Ikisan, 2004). Also, the wide gap between rural and urban prices weakens the farmers' morale thereby reducing productivity and in some cases stoppage of production (Care, 2004). High rising cost of labour and equipment also constitutes a major hindrance to rice marketing, especially these days that family labour is not readily available. This study therefore is set to look at the performance and structure vof the retail rice market in Enugu state, Nigeria. Specifically, the study describes the socioeconomic characteristics of the rice marketers, analysis the performance of the rice market and describes the structure of the market.

METHODOLOGY

The study area was carried out in Enugu State of Nigeria. According to Ezike (1998), the State is located within the following geographical coordinates: - $5^{0}56^{1}$N to$7^{0}06^{1}$N, and $6^{0}53^{1}$ to $7^{0}55^{1}$E. Enugu. It occupies an area of about 8,022.95km2 (Ezike, 1998) and has a population of about

3,257,298 (NPC, 2006). The State is a major producer of rice in the South-east geopolitical zone of Nigeria.

The population of this study comprised of all retail rice marketers in the three agricultural zones of Enugu State. Multi-staged and random sampling techniques were adopted for the study. At the first stage, two agricultural zones with high concentration of rice marketers were purposively selected. Two Local Government Areas were selected from each agricultural zone giving a total of two Local Government Areas for the study. Next, four communities were selected from each Local Government Area giving a total of eight communities for the study. Lastly, 10 rice retail marketers were randomly selected from each community giving a total of 80 respondents for the study.

Data were collected by the means of structured questionnaire and direct observations. The data were collected on the respondent socioeconomic characteristics as well as production and marketing activities. These include: gender of household heads, types of rice sold, quantity of rice sold, cost of labour, experience, educational level, capital used, selling price, cost price, output, cost of transportation, marital status, age of household head, among others.

Data were analyzed using descriptive statistical tools such as means, frequency distribution tables and percentages. Marketing margin, marketing efficiency models and Gini Coefficient and Lorenz curve were also used for data analysis. The models are expressed as:

Marketing Margin Model

$$Marketing\ Margin = \frac{Retained\ or\ sellin\ Price - supply\ price}{selling\ price} \times \frac{100}{1} \text{ .....eqn. 1}$$

Marketing Efficiency

Marketing efficiency, as applied by Olukosi and Isitor (1990) and Ozougwu (2002), was used to determine marketing efficiency.

$$M.E = \frac{\text{Value added by marketing (net profit)}}{\text{Total marketing Cost (TMC)}} \times \frac{100}{1} \text{ ..... eqn. 2}$$

Where M.E. = Marketing Efficiency

According to Scarborough and Kydd (1992), the value of marketing efficiency ranges from 0% to infinity. If marketing efficient is 100%, the market is perfectly efficient because price increment is just high enough to cover the cost of marketing of such commodity. Whereas marketing efficiency that is greater than 100% indicated excess profit, while marketing efficiency less than 100% is an indication of inefficiency.

The model for Gini Coefficient and Lorenz curve as specified by Okutue (2013) is given as:

Gini Coefficient (G) is expressed as follows:

$$G = 1 - \sum_{i=1}^{1} x_i\, y_i \quad \text{..... Eqn. 3}$$

Where,

G = Gini Coefficient,

X_i = Percentage of rice sellers in the i^{th} class of traders,

Y_i = Cumulative percentage of rice sellers in the i^{th} class of traders.

K = Number of classes.

The Gini Coefficient varies from 0 to 1, where o implies perfect equality in the distribution. The closer the Gini Coefficient is to zero, the greater the degree of equality, the lower the level of

concentration and the more competitive are the markets. Similarly, the closer the Gini Coefficient to one, the greater the degree of inequality, the higher the concentration and the more imperfect are the markets.

a) Lorenz Curve is expressed as follows:

$$L\left(\frac{K}{P}\right) = \frac{\sum_{i}^{k=1} A_i}{A} \text{ Ai (Ranges between 0 and 1) } \ldots\ldots\ldots\ldots \text{ Equation 3}$$

Where,

k = 1, n is the position of each individual in the income distribution

i = 1, .k is the position of each individual in the income distribution.

P = total number of individuals in the population.

A_i = is the income of the i^{th} individual in the distribution.

$\sum_{i}^{k} = 1A_i$ the cumulated income up to the K^{th} individual it ranges between 0, for k=0, and A for k=n.

The Lorenz Curve is a graphical representation of income distribution. It tells which proportion of total income is in the hands of a given percentage population by relating the cumulative proportion of individuals. The x-axis records the cumulative proportion of population ranked by income level. It range is (0, 1). The y-axis records the cumulative proportion of income for a given proportion of population i.e. the income share calculated by taking the cumulated income of a given share of population divided by the total income A.

RESULTS AND DISCUSSION

Socioeconomic Characteristics

The socioeconomic characteristics of the retail marketers were analyzed and the result is presented in Table 1.

Table 1: Socioeconomic characteristics of retail rice marketers in the study area

Variable	Frequency	Percentage
Gender (dummy)		
Male	28	35
Female	52	65
Total	80	100
Marital Status		
Single	24	30
Married	56	70
Total	80	100
Level of Education		
Non-formal	48	60
Primary Education	18	22.5
Secondary Education	6	7.5
Graduate Education	6	7.5
Post graduate	2	2.5
Total	80	100
Age (years)		
20-30	16	20
31-40	58	72.5
41-50	6	7.5
Total	80	100

Mean	34.7	
Marketing Experience		
≤5	18	22.5
6-10	56	70
11-15	6	7.5
Total	80	100
Mean	8.3	

Field survey, 2017.

The result shows that females dominate the retail rice marketing in the area with (65%) of the retail marketers being females. Females are known to be more involved in postharvest agricultural activities including marketing of farm produce. Their dominance of retail rice marketing may also be connected to the small capital with which they often run their businesses Mohammed-Lawal, *et al*. (2013) also in their findings also revealed that retailing and wholesaling of rice is predominantly a female enterprise in Nigeria. Also, a huge majority of the marketers (70%) were married. The typical agrarian African society places high values on marriage as not just a means of having children but also as in the case of the females, a means of having access to resources. Furthermore, it is believed that marriage is synonymous with large household size as married individuals usually have children and other relations residing with them and these usually serve as sources of labour and possibly capital which could be used in the household's rice marketing enterprise. This finding agrees with the findings of Ibekwe *et al,* (2012) who reported that marketers with dependents have the opportunity of using family as major source of labour.

The study found that a large proportion of the marketers (48%) had no formal education. The rest had attained one level of formal education. The low literacy level of these marketers may have some implications for their marketing activities especially with regards to sourcing of capital from formal lending institutions to expand their marketing activities. It is also expected that they may not be able to keep proper records of their marketing activities and this may adversely affect the efficient marketing of rice. According to Asiegbu (2016), low literacy level could affect to a great extent the profitability of marketers. Also, Ibeagwa et al (2019) observed that education provides marketers with knowledge and skills to enhance marketing activities thereby ensuring efficiency in market performance as well as improving the standard of living of marketers.

Age also has an important role to play in the efficient marketing of rice. The result shows that majority of the rice marketers (72.5%) were within the age range of 31-40 years; an age range considered productive. The mean age was 34.7 years. The rigorous activities associated with marketing of rice implies that the marketer have to be fit and full of vigour to be able to perform them efficiently. These retail marketers are should therefore be endowed with the ability to carry out their marketing activities effectively. This result agrees with the findings of Ibeagwa et al. (2019) who reported that the mean age of rice marketers in Enugu State was 35 years. The result in the Table also shows that majority (70%) of the marketers had between 6-10 years of marketing experience. This is reasonable amount of time to learn the intricacies and skills involved in marketing the commodity within the area. This experience will also be valuable in guiding the marketing in taking decisions on the when to buy, as well as the grade, quality and quantity of rice to buy and sell. All of which will enable the marketers efficiently perform their marketing activities. According to Ibeagwa et al. (2020), there is a direct relationship between years of experience and marketing of commodities. This result differs from that of Ibeagwa et al. (2019) who reported that majority of rice marketers had experience of between 1-5 years.

Marketing performance

Table 2 shows the marketing performance of the marketers in the area. It itemized the marketing activities in rice marketing, associated costs and the returns from marketing as the product of quantity (es) and their unit prices. The gross and net marketing margins were evaluated.

Table 2: Marketing performance of retail rice marketers in the study area

Items	Description	Values	% of TC
value of rice bought (Rb)	14bags at N6,934.29	98,928.571	78.05
Loading and Offloading	14 bags at N86.67	1,199.394	0.95
Transport	14bags at ₦643.65/bag	9,011.111	7.11
Total Variable Cost		109,139.076	86.11
Depreciation		5,541.531	4.37
Storage		2,611.429	2.06
Rent	₦690/month	8,280.000	6.53
Ropes		456.000	0.36
Market dues		720.286	0.57
Total Fixed Cost		17,609.246	13.89
Total Cost (tmc)		126,748.322	100.00
value of rice sold (Rs)	14bags at ₦12,130.73	169,830.150	
Total Revenue		169,830.150	
Gross Margin		60,691.074	
Net Margin		43,081.828	
Net Margin/bag		3077.273	
Marketing Efficiency	Rs - Rb/tmc*100	55.939	

Field survey, 2017.

The results shows that an average of about 37 bags at ₦6600/bag was bought by the retailers and this amounts to ₦244,685.714 (83.15% of TC). The cost of loading and offloading was ₦7,400.0 (2.51% of TC), the cost of transportation was ₦17,665.71 (6.00%). The depreciation of fixed assets amounted to ₦49,600.60 (16.86% of TC), while the cost of storage was ₦2,342.000 (0.80% of TC), and the cost of ropes was ₦591.667 (0.20% of TC). The Total Variable costs was ₦269,751.429 (91.67% of TC), and Total Fixed Costs was ₦24,512.238 (8.33% of TC). The value of rice sold was ₦408,147.000. The gross marketing margin and net marketing margin from rice marketing was ₦138,395.571 and ₦113,883.333respectively. The marketing efficiency was 55.55%. It implies that all rice marketers are efficient; which means that amount spent on marketing services such as cost of purchase, transportation, rent, market levy and depreciation of fixed assets were less than the amount received by marketers for value addition rice marketing in the area. This means that an increase in the cost of performing marketing service (that is added time, form and place utility) by 100% will give a more than proportionate increases of 55.55% in value addition in the rice marketing for the retailers.

Market Structure of Rice Market in the Study area

The size distribution of the rice marketers' total sales income was analysed using the gini coefficient derived from the Lorenz curve. The Lorenz curve is a geometric representation of the share distribution of income among rice marketers in Enugu state. It measured the cumulative percentage of income distribution among rice marketers on the horizontal axis as seen above arranged from the poorest to the richest, and the cumulative percentage of income (total sales) of rice marketers on the vertical axis. A perfectly equal distribution of income is represented by a diagonal line; but the Lorenz curve of rice products marketers' income fell below the diagonal line which is not an exception to all real worlds Lorenz curves. Figure 4.1 shows the Lorenz curves of income distribution of retailers of rice. The perfect equality line shows a perfect distribution

amongst marketers meaning that each marketer gets the same amount of income. The graph also shows that the unequal distribution of income among the marketers. Although the Lorenz curve shows the distribution level of income, it gives us only a pictorial view of the distribution and not the degree of inequality of the distribution. The Gini coefficient helps us in calculating this degree. The coefficient ranges from 0 to 1, where 0 represents perfect equal distribution while 1 represents perfect unequal distribution.

Figure 1: Lorenz Curve of the Retailers of Rice
Gini-coeff. = 0.15

The gini coefficient of the retailers was 0.15 suggesting a fairly equitable income distribution among the rice marketers in the study area. It also shows a low concentrated and competitive market and this is also a reflection of the efficiency of the market structure in the study area since the values of Gini-coefficient is less than 0.5. The structure of the rice market in the study area is a competitive or perfect market. The market was characterized by many buyers and sellers. The conditions of entrance are not restricted and perfect knowledge of the business is required and the product is seen as homogenous by both the buyers and sellers.This means that the conditions of entrance are free entry and free exit and perfect knowledge of the business is required and there is product homogeneity. It could be said that significant equality in the distribution of income among retail marketers. This implies that there is no market concentration in the hand of few marketers as every marketer has full knowledge of what is involved in the business. Okutue (2012) who reported a gini coefficient of 0.31 for retailers of yam tubers in the Federal Capital Territory, Nigeria and concluded that the low gini coefficient depicted low concentration in the retail market attributing it to their low capital base, fairly good access to better market information on price and supply, better bargaining powers and less risk in sourcing for finance.

CONCLUSION

The study analyzed the structure and conduct of retail rice marketing in Enugu State Nigeria. It specifically investigated the socioeconomic characteristics of the rice marketers, estimated the marketing performance and described the market structure of the rice market. The study concludes that retail rice marketing in the area is dominated by females and most marketers are in their productive age. Also, marketing is profitable; the rice market in the area is efficient and is moderately perfect with fairly equal distribution of income.

RECOMMENDATIONS

The study recommends as follows:

i. Young people and those still in their productive age should be encouraged venture into rice marketing since these young ones are better endowed with the ability to carry out marketing functions efficiently.
ii. The provision of farm inputs and supportive infrastructure by government and other stakeholders will reduce the cost of production of rice and directly reduce the price at which the retailers buy rice from source. This will in turn improve income from rice marketing.
iii. The marketers should be encouraged to get some form of literacy as this will help them increase their efficiency in the performance of marketing functions.

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EFFECTS OF RISK BEHAVIOUR ON THE INVESTMENT LEVELS OF RICE ENTREPRENEURS IN SOUTHEAST, NIGERIA

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ABSTRACT

Investment of rice entrepreneurs in south East Nigeria has continued to be of great concern to stakeholders in the agricultural sector. This study therefore examined the effects of risk behaviours on the investment levels of rice entrepreneurs in Southeast, Nigeria. A multistage sampling technique was used to select 240 rice entrepreneurs for the study. Data were collected from the respondents using a validated questionnaire. Data collected were analyzed using simple descriptive statistics like percentages and means. Inferential statistics such as Ordinary Least Square regression model and ANOVA were also used to analyze the collected data. The result of this study showed that Farming experience, amount of farm and non-farm income, farm size, amount of savings and membership of farmer's association were the significant factors that influenced the level of investment of risk-taking rice entrepreneurs in the last production season. Farming experience, amount of farm and non-farm income, farm size, and educational level were the significant factors that influenced the level of investment of risk neutral rice entrepreneurs in the last production season. For the risk-taking rice entrepreneurs, the semi-log model was chosen as the lead equation and the result shows that the value of the coefficient of multiple determinations (R^2) was 0.819. Farming experience, amount of farm and non-farm income, farm size, educational level and amount of savings were the significant factors that influenced the level of investment of the pooled rice entrepreneurs in the last production season. This study therefore recommends that Agricultural stakeholders such as Federal Government, State Government through ADP, politicians and other actors in the supply chain should strive towards reducing the cost of seeds/ seedling of rice.

Keywords: Risk behavior, investment levels, rice. Entrepreneurs

INTRODUCTION

Risk plays important role in farmer's decision making and therefore affects agricultural investment of rice entrepreneurs. Agriculture is the most weather dependent of all human activities and drought presents the greatest risk, given that it occurs with the greatest frequency, affects the greatest area, and causes the greatest losses to production (Adeyinka, 2015). Risk is regarded as a central issue that affects different aspects of people's livelihoods in the developing world. It affects whether people can maintain assets and endowments, how these assets are transformed into incomes via activities and how these incomes and earnings are translated into broader development outcomes. In rural area, risk is present in all management decisions of agricultural systems as a result of price, yield and resource uncertainty. Indeed, farmers take their decisions in a risky environment so that the consequences of these decisions are often not known with certainty until long after those decisions occur. As a result, outcomes may be better or worse than expected (Alderman, 2008; Taphee, 2015). Rice entrepreneurs are exposed to the possibilities of losses in production and uncertainty of return on their investment. Risk, which plays a vital role in rice entrepreneurs (farmers) production decisions related to choices and levels of inputs and outputs. Empirically, how farmers decide under risky conditions is best analyzed by taking into account their risk perceptions and risk attitudes or preferences (i.e., risk-averse, risk-taking, or risk-neutral). Farmers whose survival hinges on production may be more sensitive to income variability than to average income and often exhibit high aversion to risk (Luke, 2011). Risk aversion is the willingness to accept a lower expected return to obtain lower risk (Roumasset 1979). Prediction of

behavior in risky situations depends on how much is known of the individual's willingness to take risks. For instance, farmers could be risk-averse yet willing to take risks. Risk behavior of agents is determined not only by preferences but also by availability of institutions that facilitate the risk bearing (Roumasset 1976). Farmers may perceive farming as risky, not risky, or neutral considering the various sources of risk. Risk aversion is a source of inefficiency, which may lead to misallocation of resources. The objective of the study was to analyze the effects of risk behaviour on the investment levels of rice entrepreneurs in south east, Nigeria.

Risk has important implications on agriculture in that it affects the types of investments that farmers make. Ultimately, it affects the level of farm output and economic growth precisely. Information on the risk behaviour of agro entrepreneurs in south eastern Nigeria is vital in that farmers in this part of the country battle with many risk like production risk, financial risk, market risk, institutional risk and also human risk that affect productivity , income , poverty status of the crop farmers. Pieces of Information on risk behaviour of rice farmers in this study will be an addition to the body of existing knowledge in agriculture in that It provides a set of farmers that adopt various risk behaviours in farm investments that determine the risk management strategies required and hence the investments levels and pattern they should embark on. Therefore empirical knowledge of the relationship between farmers' risk behaviour and investment levels in the domain of rice production has to be verified enough in south East Nigeria. This is because only few researchers have worked on rice farmers' perception and attitude to risk, risk strategies adopted by farmers, production risk, influence of risk attitude on poverty status (Ayinde *et al* .2008). Thus, carrying out a study on rice farmers risk behaviour as it affects their investment in south eastern Nigeria is of paramount importance. Understanding the reasons for which some rice entrepreneurs prefer to be risk averse, risk neutral and taking in their behaviours is worth researching. This document will be relevant to farmers, scholars, and as well the government for policy formulation.

METHODOLOGY

The population of this study consist of all the rice entrepreneurs (producers) in Ebonyi State, Nigeria. A combination of purposive sampling and a multistage sampling techniques was adopted for this study in ascertaining the sample frame. Ebonyi State was purposively selected for the study as a representation of the southeastern states predominately known for rice production. The state was purposively selected because of its high level of commitment in rice production in Southeast Nigeria (National Bureau of statistics, 2007). Hereafter, a multistage random sampling technique was adopted in the selection of local governments, communities, villages and the respondents. The selection of the respondents for the study cut across the three (3) agricultural zones in Ebonyi state. In the first stage, two Local Government Areas (LGAs) were selected from each of the three Agricultural zones in the state. This gave a total of six (6) LGAs sampled for the study. In the second stage, two communities were randomly selected from each of the selected LGA. This gave a total of twelve (12) communities randomly sampled for the study. In the third stage, two villages were randomly selected from each of the twelve (12) selected communities, this gave a total of twenty four (24) villages for the study. In the fourth stage, ten (10) rice farmers were randomly selected from each of the selected villages for the study. This gave a grand total of two hundred and forty (240) rice entrepreneurs for this study. Model specification was as follows:

The implicit form of OLS regression for the factors that influenced investment is specified as follows;

$I = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_{8,} + e)$.

Where: I= Amount invested (₦)

X_1 = Farming experience (years)
X_2 = Primary occupation (Farming =1, 0 = otherwise)
X_3 = Amount of farm and non-farm income (₦)
X_4 = Farm size (Ha)
X_5 = Education level (number of years spent in school)
X_6 = Amount of Savings (₦)
X_7 = Household size (number)
X_8= Membership of farmers association (Yes = 1, No = 0)
e = Error term
and post hoc test were used to achieve the objectives of this study.

RESULTS AND DISCUSSION

Level of investment of rice entrepreneurs by their risk behaviour

The result of the estimation of the level of investment of rice entrepreneurs based on their risk behaviour is presented in Table 1.

Table 1: Estimation of the level of investment of rice entrepreneurs by their risk behaviour

Level of Investment	Risk Averse		Risk Neutral		Risk-Taking		Pooled	
	Value(₦)	%	Value(₦)	%	Value(₦)	%	Value(₦)	%
Seeds/seedlings	22,352.09	20.4	31,794.33	21.8	49,575.16	17.2	34,573.86	19.1
Fertilizer	10,949.56	10.0	14,560.91	10.0	30,649.12	10.7	18,719.86	10.3
Agrochemicals	2,184.73	2.0	4,079.26	2.8	16,350.03	5.7	7,538.01	4.2
Labour	8,910.58	8.1	13,610.93	9.3	26,220.34	9.1	16,247.28	9.0
Processing cost	15,507.11	14.2	21,306.48	14.6	49,501.51	17.2	28,771.70	15.9
Transportation cost	5,300.23	4.8	8,429.86	5.8	21,246.19	7.4	11,658.76	6.4
Marketing charges/levy	4,463.69	4.1	5,983.12	4.1	12,670.59	4.4	7,705.80	4.3
Renting of farm land	25,416.34	23.2	28,545.08	19.6	47,011.67	16.4	33,657.70	18.6
Farm equipment (Depreciated values)	14,327.19	13.1	17,669.52	12.1	34,298.38	11.9	22,098.36	12.2
Total	**109,412**	**100.0**	**145,979**	100.0	**287,523**	100.0	**180,971**	100.0

Source: ***Computed by the researcher from field survey data, 2020***

The result of the study shows that risk averse rice entrepreneurs averagely invested between ₦2,184.73 in agrochemicals to ₦25,416.34 in renting of farm land. Investment in renting of farm land accounted for 23.2% of the total amount invested in the last farming season by risk averse rice entrepreneurs in the study area representing the highest level of investment on farm inputs by this group of respondents. This was followed by 20.4% investment in seeds/seedlings by risk averse rice entrepreneurs in the study area. The least level of farm inputs invested by risk averse rice entrepreneurs in the study area was on the purchase of agrochemicals which accounted for a paltry 2.0% of the total amount of cash invested in rice production by risk averse rice entrepreneurs in Southeast Nigeria. In all, a total amount of ₦109,412.00 was averagely invested in rice production by risk averse rice entrepreneurs in the study area in the last production season.

Similarly, the result in Table 1 shows that risk neutral rice entrepreneurs averagely invested between ₦4.079.26 in agrochemicals to ₦31,794.33 in seeds/seedlings. Investment in seeds/seedlings accounted for 21.8% of the total amount invested in the last farming season by risk neutral rice entrepreneurs in the study area representing the highest level of investment on farm inputs by this group of respondents. This was followed by 19.6% investment in renting of farm

land by risk neutral rice entrepreneurs in the study area. The least level of farm inputs invested upon by risk neutral rice entrepreneurs in the study area was on the purchase of agrochemicals which accounted for a paltry 2.8% of the total amount of cash invested in rice production by risk neutral rice entrepreneurs. In all a cumulative total amount of ₦145,979.00 was averagely invested in rice production by risk neutral rice entrepreneurs in the last production season. The result further shows that risk neutral rice farmers invested ₦9,442.24, ₦3,611.35, ₦1,894.53, ₦4,700.35, ₦5,799.37, ₦3,129.63, ₦1,519.43, ₦3,128.74, and ₦3,342.33 in seeds/seedlings, fertilizer, agrochemicals, labour, processing cost, transportation cost, marketing charges/levy, renting of farm land, and farm equipment more respectively more than risk averse rice entrepreneurs in the study area. Cumulatively, risk neutral rice entrepreneurs invested ₦36,567.97 more in rice farming than risk averse rice entrepreneurs and ₦141,543.50 less in rice farming than risk-taking rice entrepreneurs.

More so, the result in Table 1 shows that risk taking rice entrepreneurs averagely invested between ₦12,670.59 as marketing charges/levy to ₦49.575,16 in seeds/seedlings. Investment in seeds/seedlings and rice processing jointly accounted for 17.2% of the total amount invested in the last farming season by risk taking rice entrepreneurs in the study area representing the highest level of investment on farm inputs by this group of respondents. This was followed by 16.4% investment in renting of farm land by risk taking rice entrepreneurs in the study area. The least level of farm inputs invested upon by risk taking rice entrepreneurs in the study area was on marketing charges/levy which accounted for a 4.4% of the total amount of cash invested in rice production by risk taking rice entrepreneurs. In all a cumulative total amount of ₦287,523.00 was averagely invested in rice production by risk taking rice entrepreneurs in the last production season. The result further shows that risk-taking rice farmers invested ₦27,223.07, ₦19,699.56, ₦14,165.30, ₦17,309.76, ₦33,994.40, ₦15,945.96, ₦8,206.90, ₦21,595.33, and ₦19,971.19 in seeds/seedlings, fertilizer, agrochemicals, labour, processing cost, transportation cost, marketing charges/levy, renting of farm land, and farm equipment respectively more than risk averse rice entrepreneurs. In all, the risk-taking rice entrepreneurs in southeast Nigeria invested ₦178,111.47 more in rice farming than risk averse rice entrepreneurs. The risk takers also invested ₦17,780.83, ₦16,088.21, ₦12,270.77, ₦12,609.41, ₦28,195.03, ₦12,816.33, ₦6,687.47, ₦18,466.59, and ₦16,628.86 in seeds/seedlings, fertilizer, agrochemicals, labour, processing cost, transportation cost, marketing charges/levy, renting of farm land, and farm equipment respectively more than risk neutral rice entrepreneurs. In all, the risk-taking rice entrepreneurs in southeast Nigeria invested ₦141,543.50 more in rice farming than risk neutral rice entrepreneurs.

Furthermore, the result in Table 1 shows that rice entrepreneurs averagely invested between ₦7,538.01 in agrochemicals to ₦34,573.86 in seeds/seedlings. Investment in seeds/seedlings accounted for 19.1% of the total amount of cash invested in the last farming season by rice entrepreneurs in the study area representing the highest level of investment on farm inputs by the respondents. This was followed by 18.6% investment in renting of farm land by rice entrepreneurs in the study area. The least level of farm inputs invested upon by rice entrepreneurs was on agrochemicals which accounted for a 4.2% of the total amount of cash invested in rice production by rice entrepreneurs. A cumulative of ₦180,971.00 was averagely invested in rice production by rice entrepreneurs in the last production season.

Evidence from the result of this study shows that purchase of seeds/seedlings and acquisition of land are the most demanding aspects of investment in rice farming in southeast Nigeria. The high level of investment in seeds/seedlings suggests high cost of purchase of seeds/seedlings which may be due to lack of sufficient rice seeds/seedlings for purchase in the study area. On one hand, it may

also be that the traditional method of raising rice seedlings in the nursery by local rice farmers may not be adequate to meet up with the demand for rice seeds/seedlings for planting. Also, it could be that the rice farmers prefer to purchase improved varieties of rice which are not adequately available at a reduced cost. This is a pointer to the national need for increased supply of rice seeds/seedlings to farmers. Government institutions saddled with the responsibility of providing improved rice seeds/seedlings to farmers need to wake up to the reality that they are not fulfilling their national mandates as this is evident from the high cost of purchase of rice seeds/seedlings by the rice entrepreneurs. The high level of investment on farm land is evidence of high cost of acquiring land for farming. This is associated with the dense population of the area which has occasioned land fragmentation and the use of land for non-agricultural development purposes. Therefore, available lands for farming are given out at higher cost to farmers. This finding is consistent with the findings of Chidiebere-Mark, Ohajianya, Obasi and Onyeagocha (2019) who recorded high levels of investment in seeds and renting of farmlands among other farm inputs in their study on profitability of rice production in different production systems in Ebonyi state, Nigeria.

Multiple regression result

Table 2: Ordinary Least Square (OLS) multiple regression result of the estimated factors influencing the level of investment of rice entrepreneurs based on their risk behaviours

Variable	Risk Averse (EX)	Risk Neutral (DL)	Risk Taking (SL)	Pooled (DL)
Constant	14.316	4.175	1260634.18	8.856
	(10.311)***	(7.286)***	(8.983)***	(7.111)***
Farming experience (X_1)	0.756	1.860	11788.088	1.179
	(3.411)***	(5.912)***	(3.276)***	(2.543)**
Primary occupation (X_2)	1.75E-06	-0.001	1067.112	0.021
	(1.227)	(-0.225)	(1.545)	(1.496)
Amount of farm and non-farm income (X_3)	0.705	1.334	12346.274	1.150
	(4.230)***	(3.413)***	(2.487)**	(3.240) ***
Farm size (X_4)	0.632	1.052	11603.822	1.801
	(2.275)**	(2.784)***	(2.996)***	(3.511)***
Educational level (X_5)	0.521	1.078	-14111.403	1.087
	(1.098)	(3.264)***	(-0.442)	(2.368)**
Amount of Savings (X_6)	0.344	0.026	25443.336	0.977
	(2.419)**	(1.405)	(2.614)**	(2.211)**
Household size (X_7)	-0.726	0.012	11475.567	-0.047
	(-2.346)**	(1.529)	(1.294)	(-1.516)
Membership of farmer's association (X_8)	1.60E-06	-0.146	17294.68	0.427
	(0.621)	(-1.548)	(3.677)***	(1.496)
R^2	0.772	0.727	0.819	0.865
Adjusted R^2	0.754	0.701	0.793	0.842
F- statistic	58.476***	54.624***	62.383***	71.204***

Source: ***Computed by the researcher from field survey data, 2020***

***, and **represents 1% and 5% levels of significance

EX = Exponential model; DL = Double-log model; SL = Semi-log model. Figures in parenthesis are t-ratio

For the risk neutral rice entrepreneurs, the double-log model was chosen as the lead equation and the result shows that the value of the coefficient of multiple determinations (R^2) was 0.727. This

implies that 72.7% of the variations in the level of investment of risk neutral rice entrepreneurs was explained by the regressors included in the model. The f-value of 54.624 was significant at 1% level, indicating the significance of the entire model. Farming experience, amount of farm and non-farm income, farm size, and educational level were the significant factors that influenced the level of investment of risk neutral rice entrepreneurs in the last production season. For the risk-taking rice entrepreneurs, the semi-log model was chosen as the lead equation and the result shows that the value of the coefficient of multiple determinations (R^2) was 0.819. This implies that 81.9% of the variations in the level of investment of risk-taking rice entrepreneurs was explained by the regressors included in the model. The f-value of 62.383 was significant at 1% level, presaging the significance of the entire model.

Farming experience, amount of farm and non-farm income, farm size, amount of savings and membership of farmer's association were the significant factors that influenced the level of investment of risk-taking rice entrepreneurs in the last production season. For the entire rice entrepreneurs (pooled), the double-log model was chosen as the lead equation and the result shows that the value of the coefficient of multiple determinations (R^2) was 0.865. This implies that 86.5% of the variations in the level of investment of rice entrepreneurs in southeast Nigeria was explained by the regressors included in the model. The f-value of 71.204 was significant at 1% level, presaging the significance of the entire model. Farming experience, amount of farm and non-farm income, farm size, educational level and amount of savings were the significant factors that influenced the level of investment of the entire rice entrepreneurs in the last production season. These factors could be divided in two groups: those with positive effects on the level of investment of the respondents, which include, farming experience, primary occupation, farm size, level of education, amount of farm and non-farm income, amount of savings and membership of farmer's association; and that with a negative effect on the level of investment of the respondents which is household size.

The regression coefficient of farming experience was positively and significantly related to the level of investment at 1% level of significance for risk averse, risk neutral and risk-taking rice entrepreneurs in southeast Nigeria, and at 5% level of significance for the entire rice entrepreneurs in southeast Nigeria, indicating that a direct relationship exists between farming experience and the level of investment of risk averse, risk neutral, risk-taking and the entire rice entrepreneurs in southeast Nigeria. Therefore, an increase in the years of farming experiences of risk averse, risk neutral, risk-taking and the entire rice entrepreneurs in southeast Nigeria leads to an increase in their level of investment and vice versa. Experience in farming increase by years of active involvement in farming operations. An increase in one's experience in a line of business will bring about an increase in his/her quest to invest his resources. By experience, rice entrepreneurs will invest more in rice production rather than in any other investment opportunity with a less derivable profit considering the wider availability of market for rice in Nigeria. Experienced rice entrepreneurs will be more willing to invest in rice production than inexperience rice farmers since the can understand the best combinations of resources that will give a given level of output and to handle any intricacies that may arise. Thus, their experience will help them to minimize cost so as to maximize profit. The finding with respect to farming experience is in line with *a priori* expectation and consistent with the findings of Bosma, *et al.* (2009), Ngore, Mshenga, Owuor and Mutai (2011), Nwibo and Alimba (2013), Ibitoye, Idoko, and Shaibu (2014) and Osondu, Obike and Ogbonna (2015) who found a direct relationship between farming experience and level of investment of farmers.

Table 3: Test of significant difference in the mean level of investment of rice entrepreneurs based on their risk behaviours

Level of Investment (₦)	Risk Averse (A)	Risk Neutral (B)	Risk Taking (C)	F-ratio	P-value	Remark	*Post Hoc* test
Seeds/seedlings	22,352.09	31,794.33	49,575.16	8.281	0.019	S*	C > B > A
Fertilizer	10,949.56	14,560.91	30,649.12	8.124	0.020	S*	C > B > A
Agrochemicals	2,184.73	4,079.26	16,350.03	10.122	0.010	S*	C > B > A
Labour	8,910.58	13,610.93	26,220.34	6.192	0.035	S*	C > B > A
Processing cost	15,507.11	21,306.48	49,501.51	24.412	0.001	S**	C > B > A
Transportation cost	5,300.23	8,429.86	21,246.19	39.857	0.000	S**	C > B > A
Marketing charges/levy	4,463.69	5,983.12	12,670.59	6.485	0.032	S*	C > A = B
Renting of farm land	25,416.34	28,545.08	47,011.67	14.724	0.005	S**	C > B > A
Farm equipment (Depreciated values)	14,327.19	17,669.52	34,298.38	6.492	0.030	S*	C > B > A
Total	**109,412**	**145,979**	**287,523**	**255.783**	**0.000**	**S****	**C > B > A**

Source: Computed by the researcher from field survey data, 2020

S = Significant; NS = Not significant; ** = 1% level of significance; * = 5% level of significance

The result of analysis of variance (ANOVA) in Table 3 shows great disparity in the levels of investment of risk averse, risk neutral and risk-taking rice entrepreneurs in various farm inputs with P-value (significant) which were all lesser than or equal to 0.05 level of significance and ranged from 0.000 to 0.035. The *Post hoc test* shows that the level of investment of risk-taking rice entrepreneurs in the various farm inputs was significantly higher than those of risk averse and risk neutral rice entrepreneurs at $P \leq 0.05$. Moreover, the *post hoc test* shows that the level of investment of risk neutral rice entrepreneurs in the various farm inputs was significantly higher than those of risk averse rice entrepreneurs at $P \leq 0.05$ except for marketing charges/ levy in which no significant difference existed between the level of investment of risk averse and risk neutral rice entrepreneurs in the study area. The desire for a higher expected return on investment is the major drive for the level of investment of risk-taking rice entrepreneurs while fear of lost may have affected the level of investment of risk averse rice entrepreneurs in southeast Nigeria. Therefore, we reject the null hypothesis that there is no significant difference in the level of investment in rice production business among risk averse, risk neutral and risk-taking rice entrepreneurs in southeast Nigeria and conclude that there is significant difference in the level of investment in rice production business among risk averse, risk neutral and risk-taking rice entrepreneurs in southeast.

CONCLUSION

This study focused on the effect of risk behaviour in investment levels of rice farmers in south east, Nigeria. The result of the study shows that risk averse rice entrepreneurs averagely invested between ₦2,184.73 in agrochemicals to ₦25,416.34 in renting of farm land. Investment in renting of farm land accounted for 23.2% of the total amount invested in the last farming season by risk averse rice entrepreneurs in the study area representing the highest level of investment on farm inputs by this group of respondents. This was followed by 20.4% investment in seeds/seedlings by risk averse rice entrepreneurs in the study area. The least level of farm inputs invested upon by risk averse rice entrepreneurs in the study area was on the purchase of agrochemicals which accounted for a paltry 2.0% of the total amount of cash invested in rice production by risk averse rice entrepreneurs in Southeast Nigeria. For the risk-taking rice entrepreneurs, the semi-log model

was chosen as the lead equation and the result shows that the value of the coefficient of multiple determinations (R^2) was 0.819. Farming experience, amount of farm and non-farm income, farm size, amount of savings and membership of farmer's association were the significant factors that influenced the level of investment of risk-taking rice entrepreneurs in the last production season. The *Post hoc test* shows that the level of investment of risk-taking rice entrepreneurs in the various farm inputs was significantly higher than those of risk averse and risk neutral rice entrepreneurs.

RECOMMENDATIONS

The following recommendations were made:

1. The government should through ADP provide improved rice seedlings to the rice entrepreneurs, this will help to boost the yield and income of the rice entrepreneurs in the study area.
2. Other agricultural stakeholders like Local governments should liaise with the farmers through their cooperatives to identify the risk averse group of farmers and give them better support because they are the most vulnerable group in terms of investment resources. This will make them not to quit Agriculture especially in this time of insufficient food in the country.

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THE EFFECT OF DIFFERENT RATES OF POULTRY MANURE ON DRY SEASON FARMING OF TOMATOES (*Lycopersicon esculentum*) IN DERIVED SAVANNA AREA OF DELTA STATE, NIGERIA

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ABSTRACT
A Field trial on the performance of the effect of different rate of poultry manure on dry season farming of tomatoes (*lycopersicon esculentum*) carried out in the demonstration farm of College of Education Agbor *in derived savanna Area of latitude 5^0S and 8^0N and longitude 5^0W and 7^0E of Delta State. The design was a randomized complete block with three replicates. Each plot measured 2.1 x 1m with alley of 1m between plots and replicates. There were thus, a total of 15 plots (3x5). The experiment area used was 107.3m^2. The plant spacing was 75 x 25. Cherry tomatoes variety was used. The following treatment was applied, 0kg/ha, 3.6kg/ha, 5.4kg/ha, 7.2kg/ha and 9.0kg/ha. Seed longs were transplanted after a month to the permanent plots, the effect of different rate of poultry manure was monitored on the plant height, number of leave, leave area, stem girth, number of flower, and number of fruit. Based on the findings of this study, it was concluded that the application of 9.0kg of poultry manure was the best in Agbor, Delta State for the cultivation of dry season tomatoes since this treatments have proved to be the best among the treatment and was significantly different from other treatments in term of growth and yield. Based on the findings, it was recommended that the application of poultry manure at 9.0kg be adopted by farmers in Agbor, Delta State for the cultivation of dry season tomatoes.*
Keyword: Tomatoes, Treatment, fertilizer, Growth characters, Yield.

INTRODUCTION
Tomato was derived from tomati, a word in the Nahuati (the language used by the Aztecs). Tomatoes plant belongs to the family of solanacea and the genius solanum. It has a botanical name called Lycopersicon esculetum. The plant produce the tomatoes fruit which is for purely culinary purpose, is often included among vegetables (Clerk, 2010). It probably originated from the highlands of the west coast of South America (Smith, 2010); and currently grown all over the world because of it's nutritional benefits. In Nigeria, tomatoes are grown all over the country in all seasons. However dry season tomato production has not gained popularity in the south string area. Tomatoes require a number of physical and chemical conditions to produce optimally and tolerant to a wide range of soils. According to Benton (2010), tomatoes plant grows well under a range of soil properties from sandy to fine textured clay. The soil must, however be well drained, have a good structure and is well aerated and loose. Also the soil must have subsoil characteristics devoid of naturally occurring or ploughing created hardpan (Shukla & Nails, 2010).

The tomatoes plant grows well within a soil ph range of 5.5 to 6.8 (Benton, 2011) in the opinion of Calkins (2013). A range of PH between 6.0 to 7.0 is compatible for growing tomatoes. This is exactly the range in which soil organisms do best. Considered moderately sensitive to salinity the tomato plant can tolerate a salinity level of up to 2.5 dissolve salt / meter without significant yield loss (Atherton & Rudich, 2014). Tomato plant has a high requirement for the elements K- Potassium and Ca - calcium and the micronutrients Fe - Iron, Mn - Magnesium and Zn - Zinc, has a medium requirement for the element N - Nitrogen, Mg - Magnesium, P- phosphorus, S - Sulfur and the micronutrient Cu - copper. The period of greatest nutrient requirements for NPK

is from about ten days after flowering to just before the fruit begins to ripen. There is diurnal variation in nutrient absorption. A higher production of P tends to be absorbed during the night than N or K (Atherton & Rudich, 2014). Tomato plant varies in their yield potentials. Although the genetic yield potential for the tomato plant is not known, the observed difference in yield capacities is at times traceable to the different varieties (Acquach, 2012).

However, different cultural techniques which greatly influence tomato fruit yield are planting density, fertilizer application and use of improved cultivars (Benton, 2014). The spacing for tomato actually depends on many factors which among others include soil condition, soil fertility, climate, cultivar, methods of planting, incidence of diseases and insect pest. The knowledge of plant responses to planting density provides basis for accessing intra – specific competition. (Kleni, 2011) found closer spacing (30cm between plant and 60cm between rows) resulted in higher yield and less cracked fruit per plant. Application of organic manure is an important means of maintaining soil fertility. This is because nutrients contained in organic manure are released more and slowly and are stored for a longer time in the soil, thereby ensuring a long residual effect (Zaodan, 2015). In many tropical soils, organic manure has been reported to be the major source of nitrogen, phosphorus, potassium, calcium as well as magnesium (Awodun, 2014) organic manure when properly applied has the potentials of improving soil infiltration capacity as well as impact beneficial effects on the structure of the soil (Ojeniy, 2016). Among all the organic manure poultry manure is the easiest to access, poultry manure has been found to procedure higher yield in tomatoes than any other organic manure like pig and cattle manure. This was attributed to the higher content of nitrogen and phosphorus in poultry manure coupled with the fact that it furnishes the soil with more magnesium and trace elements (Awodum, 2014). Silspour and Omidghaemi (2010) the use of poultry application enhances soil organic carbon content, soil micro – organisms, improves soil crums structure, the nutrient status of the soil and enhances crop yield the procurement of organic fertilizer by most commercial gardeners is commercial fertilizer. This is because farmers can get organic fertilizers from local sources especially from those poultry farmers who keep poultry farm on commercial basis.

Tomato is one of the most imported fruit crops in the world. It ranks second in importance to tomatoes in many countries (Parray, Ganai, & Fazli, 2011). Tomato are highly versatile and are used in thousands of recipes right across Europe, from ketchup to chowder, pizzas to bloody marys. In Nigeria, tomato is a special ingredient in the food of both the poor and the rich. Tomato stew is eaten with relish, especially on Sunday s and during festivals. Tomatoes have both nutritional and medicinal values. It is important for neutralizing the acids produced during the digestion of meat and other fatty acids (Smith, 2012). It is valuable roughage which promotes digestion and helps to alleviate constipation (Parray, Ganai & Fazli, 2011). Tomatoes is a source of carbohydrates, fats, proteins, vitamins and mineral which when eaten makes in eyes brighter than using cosmetics on it (Gojale, 2012). Tomatoes seeds, which contain 24% oil, are also of medicinal value.

According to Parray *et al* (2014), they promote gastric secretion, acts as blood purifier and keep intestines in good condition. Agricultural scientists (researchers) in research institutions and government parastatal and ministry of agriculture and much interested in promoting tomatoes production in the tropics because (perhaps, more than any other vegetable) tomatoes has great potential for improving three fundamental components of the standard of living, that is income, employment and nutrition (Cakins et al*,* 2010). Rural farmers prefer to use fertilizers for other crops like yam, maize, cassava where the investment makes economic sense (Ogunwole *et al*

2013). Despite the immense importance of tomato, the yield in Nigeria especially in Southern, Eastern part is very low, when compared to other parts of the country. There is wide spread of soil degradation which is brought about by loss of organic matter, which consequently results in soil acidity, nutrient imbalance and low crop fields (Agbede *et al*, 2012).

Emphasis is now placed on use of organic manure instead of inorganic sources of nutrient because of the need to take pure foods devoid of chemical elements that are easily absorbed from inorganic sources of nutrients. Using inorganic fertilizer in low land areas may also increase dangers of underground water pollution. Farmers cannot afford to use mineral fertilizers to boost their vegetable yields. Using these chemicals, especially on tomatoes that are consumed fresh may increase the danger of digesting these chemicals that are absorbed and partitioned to fruit or to economic yield of such crops (Williams, 2010). Since poultry droppings boost crop growth and yield (Koaramokpo, 2013), does the different rate of poultry manure have the same effect on the growth and yield of tomatoes? This study will attempt to find the effect of different rate of poultry manure on dry season farming of tomatoes (*Lycopersicon esculentum*) in derived savanna area of delta state. The study achieved the following objectives to: **e**valuate the effects of different rates of poultry dropping on the plant height, number of leaves area a stem girth, and examine the effects of different rates of poultry manure on the fruit number and yield of tomatoes.

METHODOLOGY

This study was carried out at the College of Education, Agricultural demonstration Farm Agbor which lies between latitude 5º S and 8º N and longitude 5º W and 7º E of the equator. The soil have loose brownish top soil over a great depth of large non differentiated, non mottled, non gravely porous sub soil with coarse sand as the predominant fraction and clay content is up to 35%. The climatic condition of the soils in Agbor, Delta State is similar to other part of the Southern Nigeria. There are usually two distinct seasons that is the dry season and the raining season. The raining season starts in February and continues till the end of October. The rain fall regime show a double maximum which is separated by a comparatively low total rainfall (dry period) in August called August break. The length of wet season last for at least seven months i.e. about 220 - `250 days with average rain days of 159 days. Temperature is very high during the day with cool night (Iloeji, 2003) Agbor is spread across the forest and transitional belt ecological zone. However, most of the forest are being replaced with derived savanna types of vegetation mainly by trees, shrubs and so an on in most northern parts. The vegetation is thinner, consistently disturbed by high rural population densities and bush rural population densities and bush fire, this tends to make the vegetation poorer every year (Areola, 1992).

The bulk of food crop production in the area of study is obtained under the traditional system of shifting cultivation, where holdings are small the characteristics of other farm practices are a legacy of pest generations. Crop grown include yam, maize, cassava, cocoyam, plantain, banana and variety of vegetables. Some farmers combine the cultivation of food crops with that of tree crops like oil palm, orange (citrus) kola nut, cocoa and to a lesser extent coffee (Okougbo, 1988).

EXPERIMENTAL DESIGN

The land used for the experiment was manually cleared and the debris packed without burning. The experimental layout was randomized complete block design (RCBD). Each plot measured 2.1 x 1m^2 with alley of thus a total of 15 plots (5 x 3). The experiment area used was 107.3m^2. the manure was applied two weeks before planting in each treatment at 0,1 3.6kg, 5.4 kg, 7.2kg and 9.0kg respectively. Tomato seeds (cherry tomatoe) obtained from Ministry of Agriculture

were sown on the 25th September 2019 and 2 seed per hole and later thinned to one plant per stand and watered twice a day. The space used was 75 x 25cm giving a plant population of 20 plants per plot. Weeding was done manually by using a hoe twice at 3 and 6 weeks after planting (WAP), respectively. Plant height, stem girth, number of leaves, number of flowers and number of fruits of tomatoes per plot were determined. All the parameters measured were subjected to appropriate statistical analysis using Doncan multiple range test (Steel & Tonrie, 1980)

EVALUATION OF AGRONOMIC CHARACTERS

The morphological development of tomatoes was examined for the following characters.

PLANT HEIGHT**:** At 2, 4, 6 and 8 weeks after planting a tape rule was used to measure the height of the plant from soil surface to the apex. The mean value was recorded in centimeters.

STEM GIRTH**:** The stem girth was determined by measuring with a tape rule at first node and the value recorded.

NUMBER OF LEAVES PER PLANT**:** Leaves per plant plot were counted at 2, 4, 6 and 8 weeks and recorded.

LEAF AREA**:** This was determined by measuring the length and breath of selected leaves at the middle from six marked plants per plot.

NUMBER OF FLOWER**:** Flower per plant per plot were counted at 6 and 8 weeks and recorded.

NUMBER OF FRUITS**:** The fruits harvested from each plot was weighted. This was used to estimate the fruit yield per hectare.

CORRELATION COEFFICIENT**:** This was calculated by using the Duncan multiple range test (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

Evaluation of Growth and Yield of Tomatoes

Table 1: Plant Height (cm) of Tomatoes in Delta State

Treatments (poultry manure)	(WAP) 2	4	6	8
0kg	9.35ns	9.89^{c}	12.55^{c}	17.20^{c}
3.6kg	9.55	12.10^{ab}	22.25^{bc}	25.75^{bc}
5.4kg	9.85	12.22^{b}	28.25^{ab}	35.20^{ab}
7.2kg	9.89	12.47^{a}	29.20^{ab}	41.00^{ab}
9.0kg	9.91	12.50^{a}	35.52^{a}	50.75^{a}
MEAN	9.71	11.83	25.55	33.98
DMRT	5.22	7.01	10.11	16.89

Field Survey (2020); Mean within the same column followed by the same letter(s) are not statistically different at 5% level of probability; NS = not significant.

Plant Height

Table 1 shows the plant height of tomatoes with different treatments of poultry manure. Plant height showed gradual but continuous increase among the treatments. Plant height was highest in

treatment 9.0kg with 9.0kg at 2, 4, 6, and 8 weeks after planting (WAP) and least in treatment 0kg in the same order. There was no significant difference among the plant height in all the treatments at 2 weeks after planting, but significant differences was found among the treatments at 4, 6 and 8 weeks after planting. At 4 weeks after planting there was no significant difference in the plant height of treatments 7.2kg (12.47cm) and 9.0kg (12.50cm), but at 6 and 8 weeks after planting, significant differences were noticed in both treatments.

Table 2: Leaf Girth (cm) of Tomatoes in Agbor Delta State

Treatments (poultry manure)	(WAP) 2	4	6	8
0kg	2.35^{c}	3.01^{c}	3.32^{c}	3.50^{c}
5.4kg	2.55^{b}	3.30^{bc}	3.72^{b}	4.00^{b}
5.4kg	2.57^{b}	3.42^{bc}	3.89^{a}	4.02^{b}
7.2kg	2.97^{a}	3.60^{ab}	3.91^{a}	4.25^{b}
9.0kg	3.00^{a}	3.95^{a}	4.05^{a}	4.89^{a}
MEAN	2.68	3.45	3.77	4.13
DMRT	1.01	2.23	2.99	4.11

Field Survey (2020); Mean within the same column followed by the same letter(s) are not statistically different at 5% level of probability; NS = not significant

Leaf Girth /Plant

The leaf girth/ plant of tomatoes is presented in Table 2. The result showed that the most outstanding treatment in leaf girth was treatment 9.0kg at 2, 4, 6 and 8 weeks after planting. At 2 weeks after planting, there was no significant difference in treatment 7.2kg (2.97cm) and treatment 9.0kg (3.00cm). Also, leaf girth at 6 weeks after planting showed no significant difference at in treatments 5.4kg (3.89cm), 7.2kg (3.91cm) and 9.0kg (4.05cm). however, significant differences were found at 8 weeks after planting with no significant difference noticed at between treatments 3.6kg (4.00cm), 5.4kg (4.02cm) and 7.2kg (4.25cm). leaf girth/plant was least in treatment 0kg at 2, 4, 6 and 8 weeks after planting.

Table 3: Number of leaves of Tomatoes in Agbor Delta State

Treatments (poultry manure)	2	4	6	8
0kg	6ns	6ns	10^{c}	16^{bc}
3.6kg	6	8	16^{b}	19^{ab}
5.4kg	6	9	18^{a}	21^{ab}
7.2kg	7	11	18^{a}	22^{ab}
9.0kg	9	13	21^{a}	26^{a}
MEAN	5.5	9.4	16.6	20.8
DMRT	1.01	5.15	9.22	14.22

Field Survey (2020); Mean within the same column followed by the same letter(s) are not statistically different at 5% level of probability; NS = not significant.

Number of leaves

The number of leaf/plant is shown in Table 3. As shown in the Table, there was no significant difference in the leaf area per plant among the treatments at 2 weeks after planting, although number of leafs was highest in treatments 9.0kg (9 leaves) and least in 0kg (6 leaves). The same trend was maintained at 6 and 8 weeks after planting but significant difference was noticed at 6 and 8 weeks after planting across the treatments.

Table 4: leaf area (cm^2) of Tomatoes in Delta State

Treatments (poultry manure)	(WAP) 2	4	6	8
0kg	11.25^{2}	17.05^{bc}	22.25^{c}	26.75^{bc}
3.6kg	11.75^{c}	18.87^{b}	22.85^{c}	30.02_{b}
5.4kg	15.25^{b}	19.12^{b}	33.62^{b}	48.75^{ab}
7.2kg	18.25^{b}	25.50^{a}	42.37^{ab}	50.02^{ab}
9.0kg	21.05^{a}	30.25^{a}	52.25^{a}	68.04^{a}
MEAN	15.06	22.15^{b}	24.21	44.71
DMRT	10.02	15.12	18.00	21.15

Field Survey (2020); Mean within the same column followed by the sane letter(s) are not statistically different at 5% level of probability; NS = not significant.

Leaf area

The leaf area/plant of tomatoes is presented in Table 4. Leaf area/plant showed consistent increase among the treatments at 2, 4, 6 and 8 weeks after planting. At 2 weeks after planting, significant differences were noticed with treatments 9.0kg (21.05cm^2) and least in treatment 0kg (11.25cm^2). The same trend was maintained in 4, 6 and 8 weeks after planting. At 6 weeks after planting, significant difference was noticed among the treatments but there was no significant difference in the leaf area/plant for treatments 3.6kg (22.85cm^2) and 0kg (22.25cm^2). However, the most outstanding plant with highest leaf area was treatment 9.0kg.

Table 5: Number of Flower/plant of tomatoes in Agbor Delta State

Treatments (poultry manure)	Number of flowers
0kg	2^{c}
3.6kg	4^{ab}
5.4kg	5^{b}
7.2kg	5^{b}
9.2kg	9^{a}
MEAN	4.8
DMRT	2.05

Field Survey (2020); Mean within the same column followed by the sane letter(s) are not statistically different at 5% level of probability; NS = not significant.

Number of Flower

The number of flower/plant is shown in Table 5. As presented in the table, number of flower /plant varied among the treatments. Highest number of flower/plant was found in treatment 9.0kg (9 flowers) and was least in treatment 0kg (2 flowers). Although there were significant differences in the number of flower/plant among the treatments, but there was no significant

difference in the number of flower/plant in treatment 5.4kg and 7.2kg with 5 flower/plant respectively.

Table 6: Number of Fruit/plant of tomatoes in Agbor Delta State

Treatments (poultry manure)	Number of flowers
0kg	1^{c}
3.6kg	2^{b}
5.4kg	2^{b}
7.2kg	4^{ab}
9.2kg	7^{a}
MEAN	3.4
DMRT	1.99

Field Survey (2020); Mean within the same column followed by the same letter(s) are not statistically different at 5% level of probability; NS = not significant.

Number of fruits/plant.

The number of flowers/plant of tomatoes is presented in Table 6. The result showed that number of fruit/plant was highest in treatment 9.0kg (7 fruits) and least in 0kg (1 fruit). However, there was a significant difference among the treatments with no significant difference found in treatment 5.4kg and 3.6kg with 2 fruits respectively. This result indicates that the most outstanding treatment was treatment 9.0kg.

CONCLUSION

The study focused on the effect of poultry manure on dry season tomatoes in Agbor, Delta State with different treatment levels. Five treatment levels such as 0kg, 3.6kg, 5.2kg, 7.2kg and 9.0kg were used for the experiment and the following became evident. Plant height showed significant difference at 4, 6 and 8 weeks after planting with highest being treatment 9.0kg and the least being treatment 0kg. Number of flower and number of fruit/plant were equally higher in treatment 9.0.kg with significant differences noticed among the treatment. Among all the treatments, treatment 9.0kg was the most outstanding treatment in relation to all the growth and yield parameters measured. Also, treatment 0kg was the least performing treatment intern of the growth and yield characteristics measured.

Based on the findings of the study, it was concluded that the application of 9.0kg of poultry manure was the best in Agbor, Delta State for the cultivation of dry season tomato since this treatment have proved to be the best among the treatments and was significantly different from other treatments in terms of growth and yield parameters.

RECOMMENDATIONS

Based on the findings of the study, it was recommended that;

1. The application of poultry manure ay 0.9kg be adopted by farmers in Agbor, Delta State for the cultivation of dry season tomatoes
2. Farmers should be encouraged to utilize available poultry manure since it has been found to support the cultivation of tomatoes. This will help to reduce the dependence on expensive inorganic fertilizer.

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GENDER DIFFERENTIALS IN AGROFORESTRY MANAGEMENT AMONG RURAL FARMERS IN ORLU LOCAL GOVERNMENT AREA OF IMO STATE, NIGERIA

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ABSTRACT
The study analysed gender differences in agroforestry management in Orlu local area of Imo State, Nigeria. A sample of 150 rural farmers were selected using multi-stage sampling technique. Data were collected using structured interview schedule and were analysed using percentage, mean score and t-test. Result showed that fellow farmers/friends/neighbours (78%), community-based organizations (80%) and non-governmental organizations (65%) were the major sources of information on agroforestry management among men while among women they included faith-based organizations (78%), mass media (60%) and universities (65%). The major agroforestry systems practiced by men were taungya system (57.8%), agrisilviculture (56.6%) and crop plantation (47.2%) while home garden (52.7%) was dominant among women. The roles played by men were pruning (98.0%), transplanting/plantation (92%), manuring (92%) and farm decision making (81.7%) while it was gathering of planting materials (73%), weeding (67%), thinning (71%), processing of products (76%), transporting of products (70%) and marketing of edible forest products (81%) among women. The benefits derived by men included generation of cash crops (56%), wildlife (47%) and income (45%) and those derived by women were provision of fuelwood (59%), conducive environment (56%), provision of fodder for livestock (56%) and food (46%). The barriers faced by men included difficulty in control (38%), disease and pest infestation (35%) and long period of maturity (29%) whereas those faced by the women included unavailability of information (81%), low extension coverage (90%) and poor access to credit (78%). The t-test result showed a significant difference in agroforestry management between male and female farmers.

Keywords: Gender differentials, agroforestry management, rural farmers, Imo State, Nigeria

INTRODUCTION
Forests are crucial for the goods and services they provide which people all over the world depend on. According to Gross-Camp (2017) forests are widely recognized for their environmental and social contributions to people and planet. In particular, tropical forests play a significant role in the livelihoods of the rural poor through their provision of goods (food, medicine and fuel) and services (moderating erosion, air quality and weather moderation). Langat *et al*. (2016) reported that local people depend on forest resources for various products such as fuel wood, construction materials, medicine and food. Globally, it is estimated that between 1.095 billion and 1.745 billion people depend to varying degrees on forests for their livelihoods and about 200 million indigenous people are almost dependent upon forests (Chao, 2012). In addition, 350 million people who live adjacent to dense forests depend on them for subsistence and income (Chao, 2012). It is estimated that 20 - 25% of rural people's income comes from environmental resources in developing countries (Veldeld et al., 2007) and act as safety nets in periods of crisis or during seasonal food shortages (Shackleton *et al*, 2006; Sang, 2001). Forests also have a major role in climate change mitigation by trapping and storing more than a trillion tonnes of carbon a year and are also vital for the conservation of biodiversity, supply of energy and soil and water protection (FAO, n.d.).

Forest management entails the way forests and trees within them are protected and used to provide forest products and other benefits. Forest management reduces forest degradation and deforestation while increasing direct benefits to people and the environment through sound policies and sustainable practices. At the local level, forest management contributes to people's livelihoods, income generation and employment (Chu *et al*., 2019). Gender influences individuals' roles in forest management, their access to forests and how they use forest resources (Manfre & Rubbin, 2012). Mwangi *et al*. (2011), Ingram *et a*l. (2014) and Sunderland *et al*., (2014) contend that men and women differ in their knowledge, access and use of forests. This gender disparity according to Samandong and Kjosavik (2017) is attributed to unequal power relations between men and women and these relations are constructed and shaped by a host of institutional arrangements that change over space and time (Cornwall, 2003; Agarwal, 1993). Forestry has frequently been considered a sector dominated by men, making it difficult for women's participation in forest management and decision making (Manfre & Rubbin, 2012). Women are often excluded from decision making because of social barriers, logistical barriers, the rules governing community forestry and male bias in the attitudes of those promoting community forestry. Recent studies suggest that women's participation is likely when there are less-exclusive institutions, higher household education levels and small economic inequality between genders (Colman & Mwangi, 2012).

Furthermore, management practices in agroforestry vary across gender in different locations. For instance, in southern Ethiopia, it is primarily women who tap and collect *olibanum* while in north western Ethiopia these activities are done by men (Shackleton *et al*., 2011). Gross-Camp (2017) reported that studies on gender differences in roles in forest governance have primarily emphasized a particular gender. Furthermore, the survey revealed that the studies concentrated more on the roles played by women (Erikkson, 2018; Hoskins, 2016, Food and Agriculture Organization, 2011). There is a widely held view that many researchers misconceive the meaning of gender, skewing gender studies towards women. This has led to the scarcity of studies that include men and women especially in forest management. Based on this backdrop, the study sought to provide answers to the following research questions: What agroforestry systems did men and women farmers in the study area engage in? What roles did they undertake? What did they use agroforestry for? What barriers limited their participation in agroforestry?

METHODOLOGY

The study was undertaken in Orlu local government area of Imo State, Nigeria. The area lies within latitude 5º43'45" N to 5º53'00" N and longitude 7º0'00" E to 7º7'30" E with a population of 196,600 people (National Bureau of Statistics, 2016). The local government area has 16 communities namely: Amaifeke, Amaike, Eziachi, Ihioma, Ihitte-Owerre, Mgbee, Obibi-Ochasi, Ogberuru, Okporo, Orlu-Gedegwum, Owerre-Ebeiri, Umudioka, Umuna, Umuowa, Umutanze and Umuzike (http://www.wikipedia, 2018). The climate is typically humid, with two distinct seasons, the rainy season which begins in April and ends in October, with higher intensity in June and late September and the dry season which begins in November and ends in March. The annual rainfall varies between 1,900mm and 2,200mm (Iwuji *et al.*, 2017). Temperature is generally high with little variation during the year. The mean annual temperature is about 27°C with an average annual relative humidity of 75 percent which is high during the rainy season. The vegetation of Orlu is rain forest and the topography is undulating.

The population of the study comprised men and women farmers who practiced agroforestry in Orlu local government area of Imo State, Nigeria. Sampling was done in stages. The first stage was the selection of five communities from the local government area using purposive sampling technique. This was to ensure the selection of communities where agroforestry is

dominant. The second stage was the selection three villages from each community using simple random sampling technique. The third stage was the selection of ten farmers from each of the villages from the sampling frame provided by extension agents in the area with the aid of systematic sampling technique to obtain a sample of 150 farmers.

Data for the study were obtained with the aid of interview schedule and were analysed using mean, percentages and bar charts. Hypothesis was tested using t-test.

Map of Orlu
Source: www.google.search

RESULTS AND DISCUSSION

Socioeconomic characteristics

Table 1 shows that a greater proportion of the farmers (30.1% for male) and (20.9% for women) were in the age bracket of 41 – 60 years with a mean age of 46.7 years and 54.6 years for men and women farmers respectively. This suggests that both men and women farmers were in their economically active ages. This might promote their adoption of agroforestry innovations. Besides, it might increase their scale of operation since agroforestry involves the use of physical strength. Oni (2015) reported that the majority (50.6%) of agroforestry farmers in Ekiti State, Nigeria fell within the age bracket of 26 – 50 years with an average age of 51 years implying that they are still in their economically active ages. However, the mean ages of the farmers differed with men having a lower mean age than women. This could be explained by socio-cultural factors prevalent in traditional societies which give men more access and control over natural resources like land at a younger age than women who mostly have access to land either from their husbands or children by marriage. The result showed that in all the indices for measuring marital status, men scored higher than women. However, the most significant is being married which showed a greater proportion (28.9% for men) and (20.1% for women). Akinwalere (2016) found out that 82% of agroforestry farmers in western Nigeria were married. The higher score by men could be attributed to their higher access and control over land. Access to land is basic for investments in agriculture. The result further shows that many of the farmers received one form of formal education or the other. However, a larger proportion (25.4% for men) and (17.6% for women) were educated up to the secondary school level. Education could enhance access and use of forestry innovations.

Table 1: Socioeconomic characteristics of agroforestry farmers

Socioeconomic characteristics	Male			Female		
	F	%	$\bar{X}$	F	%	$\bar{X}$
Age (Years)						
21 – 40	15	10.3		11	6.9	
41 – 60	45	30.1	46.7	32	20.9	54.6
≥ 60	28	18.3		19	12.7	
Marital status						
Single	8	5.3		6	3.7	
Married	43	28.9		30	20.1	
Divorced	2	1.2		1	0.8	
Widowed	35	23.6		24	16.4	
Educational level						
No formal education	8	5.3		5	3.7	
Primary school	19	13		13	9.0	
Secondary school	38	25.4		27	17.6	
Tertiary	23	15.3		16	10.7	
Household Size (No. of Persons)						
1 – 5	15	10.3		11	7.0	
6 -10	30	20.1	9	21	13.9	6
11 - 15	32	21.8		23	15.2	
≥ 16	11	7.1		7.4	4.9	
Farm Size (Ha)						
< 1.0	9	6.5		7	4.5	
1.0 – 2.0	32	21.2	2.5	22	14.8	0.9
2 .0 – 5.0	31	20.7		21	14.7	
> 5.0	16	7.1		11	7.4	
Farming Experience (Years)						
1 – 10	22	14.8		16	10.3	
11 – 20	40	26.5	15.6	27	18	11.2
21 – 30	20	13.6		14	9.4	
≥ 31	6	4.1		5	2.9	
Extension Visit (No. of times per						
No Contact	71	47.8		50	33.2	
Twice	15.3	10.0		11	7.0	
Thrice	2	1.2		1	0.8	
More than thrice	0	0		0	0	
Sources of access to land						
Direct inheritance	110	73.3		30	20.0	
Indirect inheritance	60	40.0		90	60.0	
Lease	110	73.3		40	26.7	
Purchase	90	60.0		60	24.6	
Rent	95	63.3		55	36.7	
From government	12	8.0		4	2.7	
From friends	30	20.0		18	12	
Access to Credit						
Yes	26	17.1		18	11.9	
No	63	41.9		43	29.1	

Source: Field Survey Data, 2021

The result implies that men farmers would be more knowledgeable in agroforestry management than their female counterparts as a result of higher exposure offered by education.

Household size varied among the farmers. A larger proportion (21.8% for men and 15.2% for women) of the farmers had a household size of 11 – 15 people. However, while the average household size was 9 persons for the men, the women farmers had 6 persons. This could be attributed to socio-cultural factors which allow men to marry more wives and thus more children. This might be an advantage to the farmer with higher household size because it can increase availability of labour and information. The farmers also differed in their farm sizes. While the majority of the farmers had farm sizes 2.0 - 5.0ha more men (21.2%) belonged to this group than women (14.8%). The average farm size as well varied, 2.5ha and 0.9ha for men and women farmers respectively. This suggests unequal access to land by both farmers. Chu *et al*. (2019) reported that male-headed households had higher access to land than female-headed households in Vietnam. Farming experience also differed between the farmers. Although, the majority (26.5% for men and 18% for women) of the farmers had farming experience of 11-15 years their average farming experience differed, 15.6 and 11.2 years for men and women farmers respectively. This suggests that the men have practiced agroforestry for a longer period and might thus possess more knowledge of forest management than women. A large proportion of both farmers reported they had no extension contact. In terms of visit, more men farmers (10.0%) were visited twice than female farmers (7.0%). In spite that extension coverage was generally low, the result showed disparity with men receiving more visit than women. Ragasa *et al*. (2012) reported a disproportionate access to extension service between male and female farmers with male farmers having a higher access than their female counterparts.

The result further revealed variation in sources of access to land. While the men farmers dominated in all the sources listed women only dominated in indirect inheritance of land. Indirect inheritance in the context of the study refers to all forms of inheritance that do not accrue to the farmer directly. It is either from the husbands or children. Access to credit also differed between the farmers. Though it was generally poor, women farmers had a relatively lower access than their male counterpart. This could be attributed to the socio-cultural barriers instituting differences in access to resources along gender lines in traditional societies. These might limit access to agroforestry innovations especially among women farmers. Croppensted *et al*. (2013) reported unequal access to productive resources between men and women farmers. According to them, women farmers have limited access to credit and other resources and this limits their participation in agriculture.

Sources of information on agroforestry management practices

Figure 1 reveals that men and women farmers shared the same sources of information on agroforestry management practices but their access to those sources differed in the study area. According to the figure, community-based organizations (80%), fellow farmers/friends/neighbours (78%), non-governmental organizations (65%), social media (50%) and extension agents (49%) promoted men's access to information on agroforestry more than women's while universities (65%) and faith-based organizations (78%) did the contrary. This suggests unequal exposure to the various sources of information on agroforestry management practices in the study area. Gitonga and Mukoya (2016) reported that universities, extension agents, research institutions, mass media and individual farmers were sources of information on agroforestry among farmers in Kenya. Similarly, Karshie *et al.* (2017) found that ADPs, mass media, fellow farmers and publications were sources agroforestry information in Nigeria.

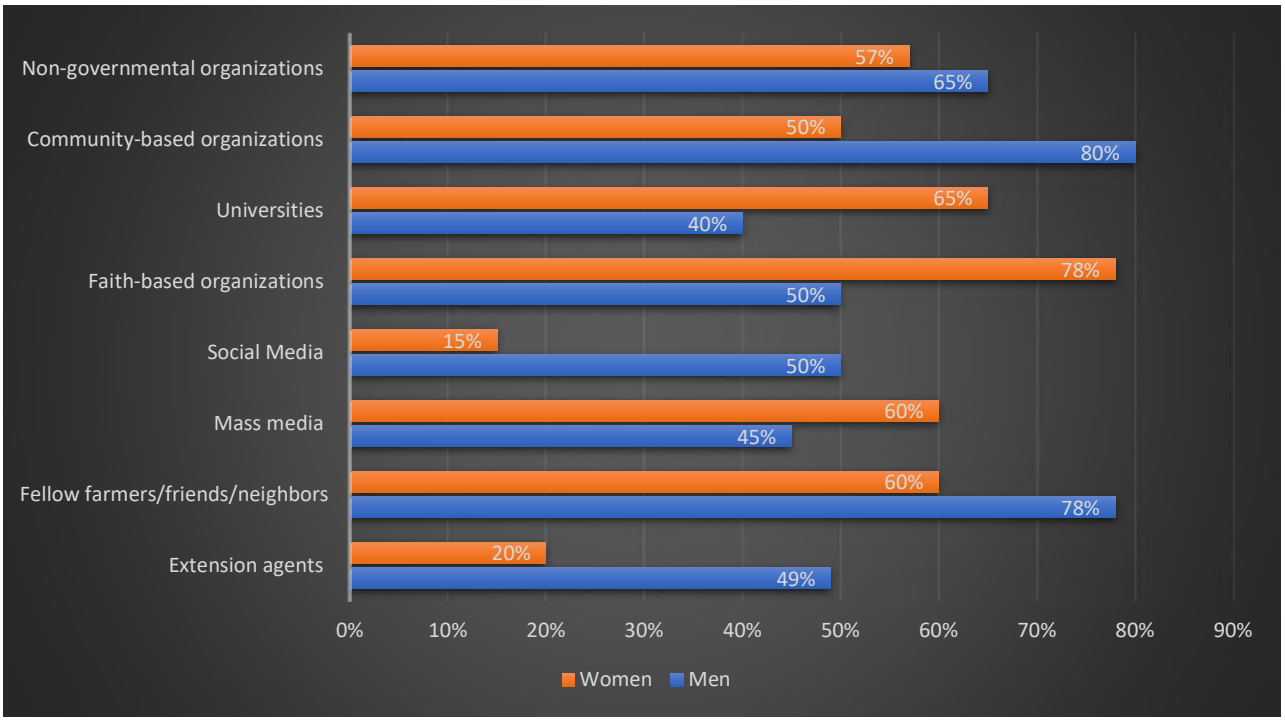

Figure 1: Bar chart showing sources of information on agroforestry management practices; Field Survey Data, 2021

Agroforestry systems practiced

Figure 1 shows variations in the systems of agroforestry practiced by the farmers along gender lines. The dominant systems practiced by the farmers included taungya system, home gardens, crop plantation, silviculture, agrisilviculture and agrosilvipastoral. While the result revealed male dominance in other agroforestry systems listed, women dominated only in the practice of home gardens. It could be deduced from the result that the men farmers were more interested in agroforestry systems that required large expanse of land and encourage tree planting while women concentrated more on those that have less demand for land, generate food and livestock fodder. Food and Agriculture Organization (FAO) (2013) reported that while men are usually interested in trees for commercial purposes women are more inclined to favour multipurpose tree species for subsistence use such as those that provide food, fuelwood and fodder and help to improve soil fertility. Kipot and Franzel (2011) confirmed that women's participation is very high in enterprises such as production and processing of indigenous food and vegetable products that require less labour inputs.

Furthermore, the nature of land allocation to women does not often support the planting of perennial and cash crops. The lands are always marginal, small and located near homes. This hardly encourages the planting of trees especially those that are perennial. FAO (2011) noted that home gardens are prominent forms of land use in traditionally matrilineal societies.

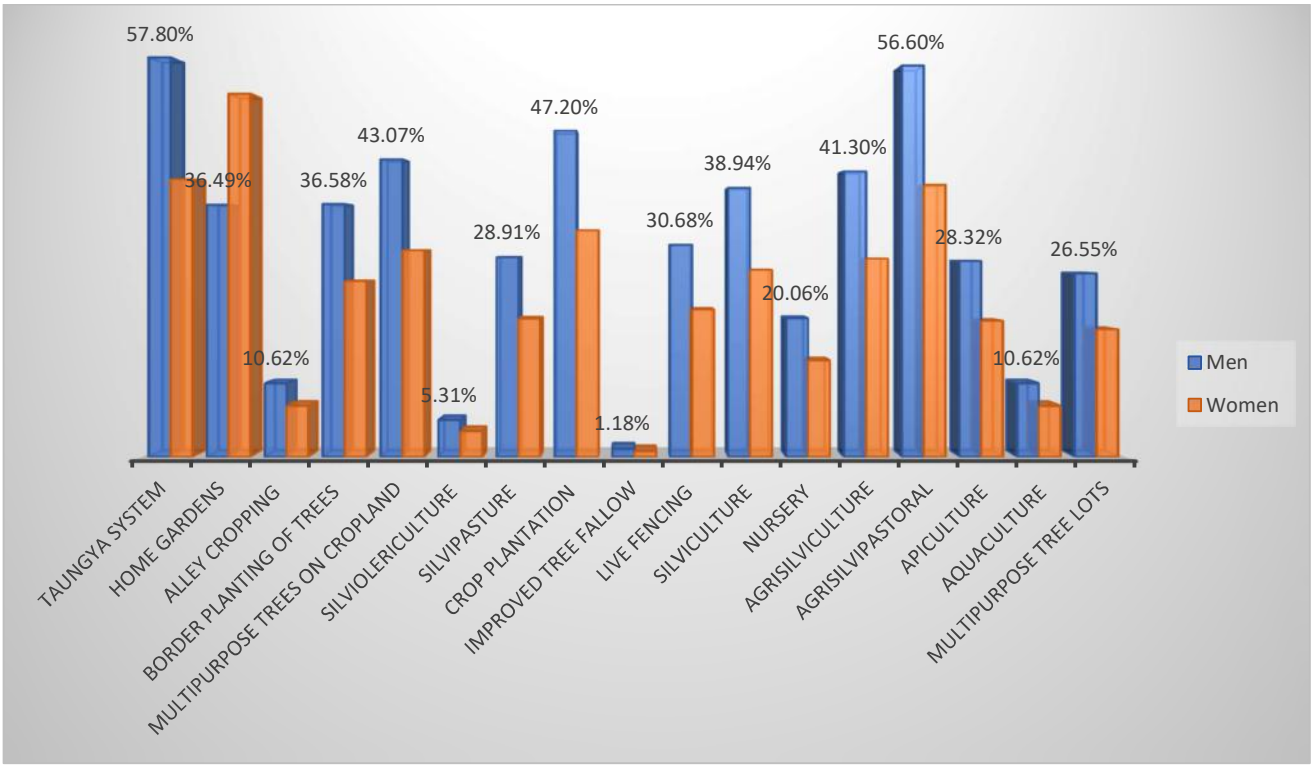

Figure 1: Agroforestry systems practiced by men and women farmers
Field Survey Data, 2021

Roles played by farmers in agroforestry

Figure 2 reveals that roles played in agroforestry by the farmers varied according to gender. The result shows that men were dominant in such roles as pruning (98.0%), planting/transplanting (92.0%), manuring (92.0%), expansion of farm (92.7%), storage of products (92.0%), marketing of non-edible forest products (80.7%), watering of seedlings (86.7%), fam decision making (81.6%) and disease control (55.4%). However, women were more involved in such activities as sourcing planting materials (73%), weeding (67%), thinning (71%), processing of harvested products (76.0%), transportation of products (70.0%) and marketing of edible forest products (81.0%). The result suggest that men were more involved in tasks that required physical strength. FAO (2013) noted that women's roles in agroforestry management revolve around watering, weeding and planting. Mukadasi and Nabalegwa (2007) reported that women carried out planting/sowing of maize, weeding and nursery management while men undertook land preparation and ploughing, planting trees, harvesting trees and marketing, buying inputs and supervision in Uganda.

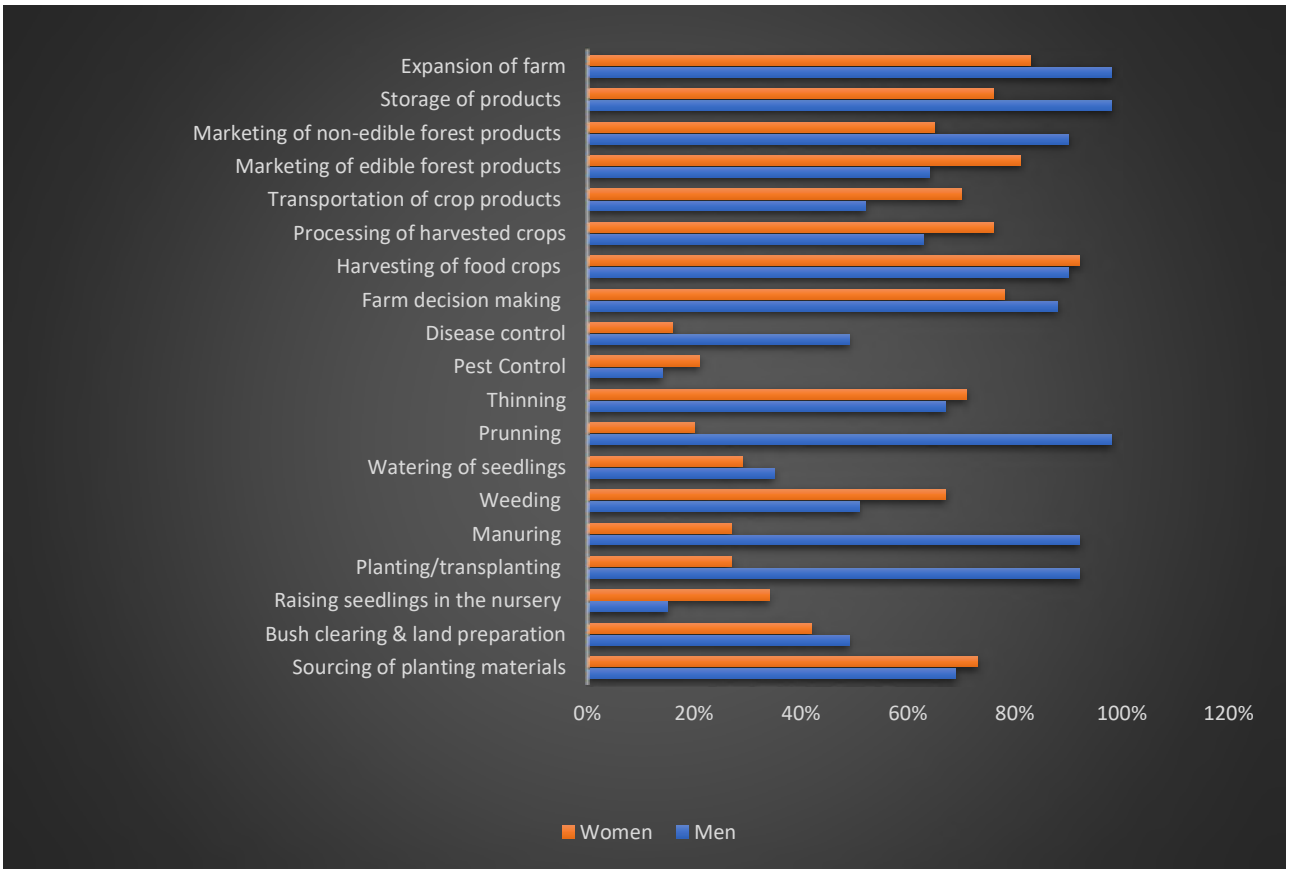

Figure 2: Roles played by men and women farmers in agroforestry
Source: Field Survey Data, 2021

Perceived benefits of agroforestry

Figure 3 shows that perceived benefits of agroforestry differed across gender. According to the result men derived more benefits from agroforestry than women farmers. Men perceived agroforestry as generating cash crops (56%), wildlife (47%) and income (45%). In the other hand, agroforestry was perceived by women to be beneficial in the provision of feed for animal (54%), fuelwood (59%), conducive environment (56%) and food (46%). This reflects the different uses agroforestry is put to by men and women. A study by Sarah-Lan *et al*. (2019) concluded that benefits derived from agroforestry varied by gender. According to the result production of water, provision of shade, provision of fire wood and construction wood, production of food and delimitation of plots were ranked by men while protection of water, provision of medicinal plants, stabilization of banks of channels, provision of food and protection of croplands ranked highest among women. Haverhals *et al.* (2014) reported that men participate more in agroforestry value chains when the value of the products increases and that men typically participate to commercialize products

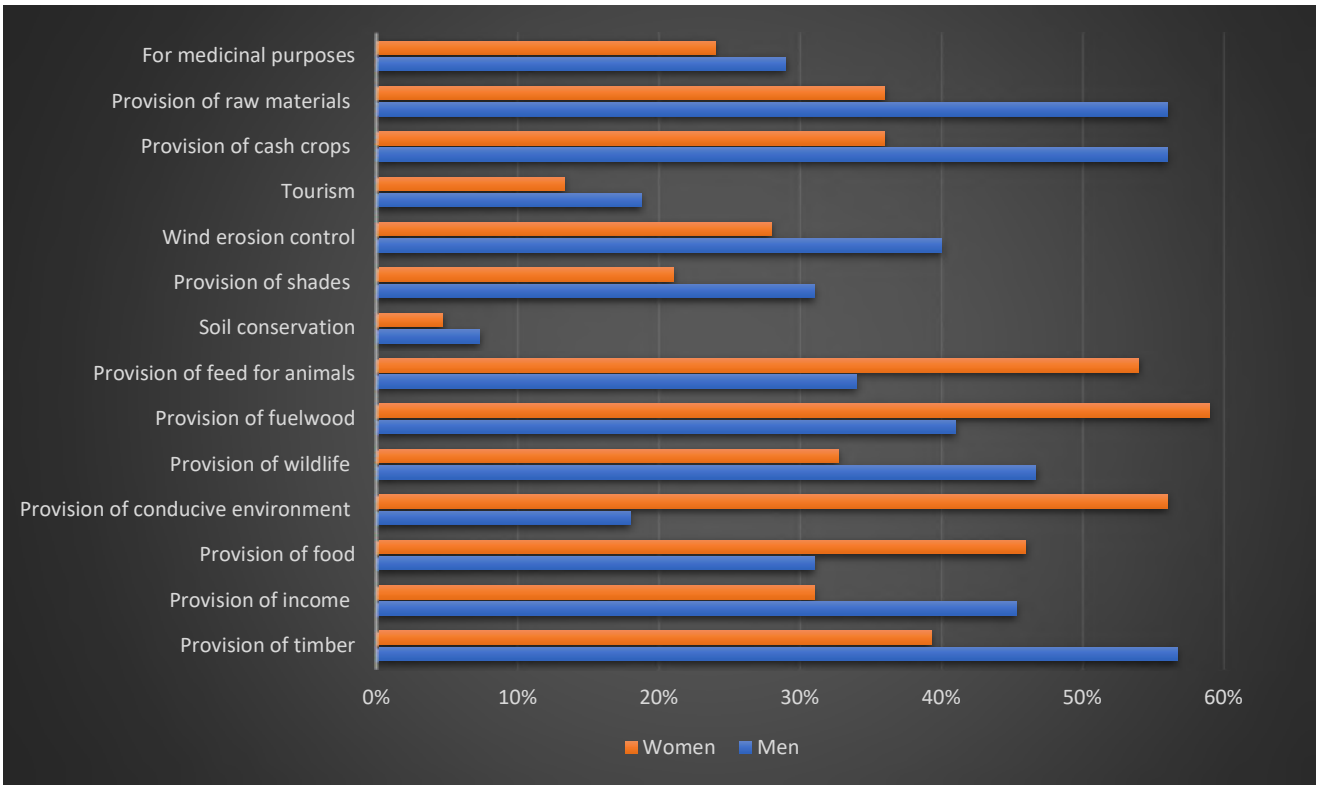

Figure 3: Bar chart showing perceived benefits of agroforestry

Field Survey Data, 2021

Barriers to agroforestry management

Figure 4 shows the disaggregation of barriers to agroforestry management according to gender. The result shows that many barriers limited women's involvement in agroforestry management. However, the major barriers they faced were low extension coverage (90%), unavailability of information (81%), poor access to credit (78%), soil infertility (76%) and inappropriate tools/machines (65%). For men, the major barriers included difficulty in control (38%), severity of practices involved (16%), lack of technical know-how (18%), disease and pest infestation (35%) and long period of maturity (29%). Colfer *et al*. (2015) reported lack of technical capacity, lack of labour, difficulty to practice as the major limiting factors faced by male agroforestry farmers whereas high initial investment was the major barrier faced by women in north western Vietnam. Karshie *et al*. (2017) reported water shortage, high cost of labour, finance/capital, long gestation period and pest/disease attack as barriers to agroforestry in Nigeria. According to World Bank (2007) many farmers living in poverty who could benefit from agroforestry practices lack buffers and capital to do long-term investments and their access to credit is generally low. This is particularly apparent for women who receive less than 10% of the credit in developing countries because they lack ownership of land used as a collateral.

Furthermore, the long return on investments for agroforestry practices discourages farmers from investing when land and tenure rights are unclear (Karlson, 2018). This is common in lower income countries and particularly farmers living in poverty especially women (Murthy *et al*., 2016). Informal land rights allow farmers to claim the ownership of crops and not of trees. This phenomenon especially applies to women as their rights to the land they manage are in general much weaker than for men (FAO, 2011). Women receive less extension services

than men and face challenges in acquiring knowledge from information systems. Most of the extension workers are men and, in some societies, and communities, socio-cultural barriers prevent women engaging with them. Extension services and information are often addressing farmers with higher educational levels, preventing many women from acquiring information because in general have a lower educational level than men (Kipot and Franzel, 2011).

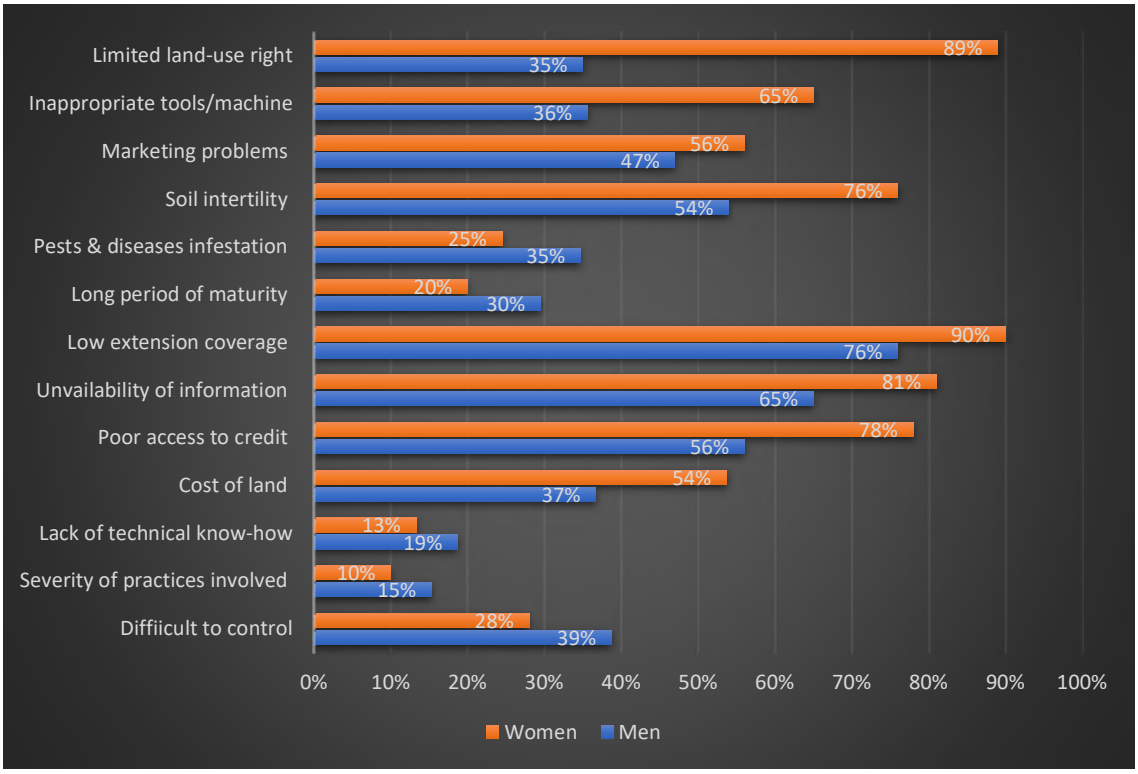

Figure 4: Bar chart showing barriers to agroforestry management

Source: Field Survey Data, 2021

Test of hypothesis

Table 2 shows that men and women farmers differed significantly in the roles they played in agroforestry in the study area. According to the result, at p-value ≤ 0.05, men played an average of 14 roles while the women played an average of 9 roles. This suggests that men undertook more tasks in agroforestry management than women.

Table 2: Differences in gender roles in agroforestry management

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Roles	Male	89	13.9663	2.99032	0.31697
	Female	61	9.0164	3.34909	0.42881

Source: Field Survey Data, 2021; Significant at 5%

CONCLUSION

The study showed that men and women farmers differed in their agroforestry management practices. Men were involved in many agroforestry systems than women and this is perhaps due to their higher access to factors of production over women farmers. Men played roles that have higher physical energy requirement than women. The benefits also were gender sensitive. Men

perceived agroforestry as contributing more to income generation while women perceived it as generating food for humans and livestock. The barriers also differed depicting unlimited access to resources needed for agroforestry among genders.

RECOMMENDATIONS

From the findings of the study the following recommendations were made:

1. Technical knowledge of men and women farmers on agroforestry management should be enhanced. This can be achieved through routine organization of workshops, field days and demonstrations.
2. More field extension staff should be recruited and equipped with the necessary skills for agroforestry.
3. Gender disparity on access and control over factors of production should be resolved. This can be achieved through the formulation of new policies or the review of existing ones.

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