# ANALYSIS OF SUPPLY RESPONSE AND DEMAND FOR LOCAL RICE(*Oryza sativa L.)*IN NIGER AND BENUE STATES, NIGERIA (1980-2016)

**BY**

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**ABSTRACT**

Local This research was conducted to analyze supply response and demand for local rice (Oryza sativa L.) in Niger and Benue States. The Objectives of the study were to describe the socio-economic characteristics of local Rice consumers, analyze the trends of local Rice supply, and determine the responsiveness of local Rice to changes in price and non-price factors. The research further assessed the effect of Local Rice characteristics on its price and examine the factors inhibiting the purchase of locally produced Rice in Niger and Benue States. A multi-stage sampling technique was employed to obtain 281 producers and consumers of local Rice. Primary data was used to describe the socio-economic characteristics of the respondents. An exponential growth model was used to estimate the production growth of Niger and Benue States using secondary data (from 1980 to 2016). The Vector Autoregressive model (VAR) was used to estimate Local Rice production variables that Granger cause local Rice supply while an ARDL model was used to estimate structural breaks. The LA/Almost Ideal Demand System (LA/AIDS) was used to estimate the expenditure share, respondent's price elasticity, cross elasticity and income elasticity of both short local Rice and long local Rice grains. Hedonic model and Kendall's coefficient of concordance were used to determine the effect of local Rice characteristics on its price and examined the factors inhibiting the consumption of local Rice respectively. The result indicated mean age of 45, 47 and 46 for the respondents Niger, Benue States and pooled. The mean annual incomes were N414,489 and N452, 000 for Niger and Benue States respectively, from 1980-2016, there were 1.90 and 1.36 percent local Rice production growth in Niger and Benue States. The Granger caused production of local Rice in Niger and Benue States. The result of OLS also confirmed that 96% of local rice

production were due to variables like area, yield, price, fertilizer and rainfall. The result of LA/Almost Ideal Demand System reveals that local Rice is a normal good and is expenditure inelastic. It also shows that long local Rice and short local Rice grains were substitutes.It is noteworthy that the coefficient of the price of short grain Rice was significantly negative and that of the substitute long grain Rice was significantly positive in influencing the share of the expenditure on short grain Rice. This implies that an increase in the prices of short grain local Rice will reduce households' expenditure share of short grain local Rice while increase in the price of the substitute, long grain local Rice will lead to Increase in the households' expenditure share of short grain local Rice *ceteris paribus,* Similarly, coefficient of the price of long grain local Rice was significantly negative and that of the substitute short grain local Rice was significantly positive in influencing the share of the expenditure on long grain local Rice. The result of Hedonic model reveals that stone free, whiteness, aroma, cohesion and taste were all significant. This means that all these attributes have great effect on price of local Rice. When these characteristics are not there, the local Rice will command low price in market. The result of Kendal's coefficient of concordance reveals 62 percent agreement of respondents on inhibiting factors of Local Rice. These respondents ranked the inhibiting factors as presence of foreign materials in that order.

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# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background to the Study

Local Rice (*Oryza sativa L.*) is an annual cereal considered as the most important crop and primary source of food for up to 40% of the world's population (Isaac and Irene, 2014). It is also a fast-growing staple food source in most African countries, providing the bulk of dietary energy for the growing population (Isaac and Irene, 2014). Local Rice accounts for 715 kcal, 27% of nutritional supply of energy, 20% of nutritional protein and 3% of nutritional fat in most countries of Africa (*Kassali et al., 2010*). Local Rice is the fifth most prominent source of energy in diet for human race, responsible for about 9% of caloric intake (Food and Agriculture Organization, 2012). It is also a source of raw materials for industries and provides employment for the teeming Nigerian population from the point of production, processing, wholesales and retails (Marlia *et al., 2011*). It is a favourite food consume during ceremonies and festivals.

Local Rice account for about 75% of food consume during festivals and ceremonies like *Idil kabir*, charismas and marriage of different kinds in Niger and Benue States (Ajijiola *et al*., 2012) Local Rice is the non-refined and non-polished Rice grain that is produced after removing the whole husk from Rice. Several efforts have been made by successive governments in Nigeria, development partners and other relevant stakeholders to increase the production of local Rice in Nigeria. These include Abakaliki Rice, Ofada Rice, Gboko Rice, Mokwa Rice and Gwakuti Rice. (Anyanwu *et al., 2017*). The grain retains the nutrient from the bran of local Rice after per-boiling making it dull white in appearance (Tonifelix, 2017). The natural consumer preferences for local Rice include; natural nutrient retains on the outer layer of the grain, regular

supply, price, dull-brightness and non-foreign materials found in the local Rice (Samuel. 2016). Due to increasing contribution of local Rice to per capita caloric consumption of Nigerians, its demand has been increasing at a much faster rate than domestic production ( Diako *et al., 2010*).

This position was also corroborated by the United States Department of Agriculture (USDA, 2012) and the Federal Ministry of Agriculture and Rural Development; (FMARD, 2016). USDA, (2012) also noted that milled local Rice utilization increased over the years, from 240 metric tonnes 1960 to 4,970 metric tonnes in 2011. Similarly, total demand for local Rice and allied products is projected to rise to 7.2 million tonnes by 2018 and production will be 3.7 million tonnes (Samuel. 2016). According to Oyinbo *et al*. (2014) local Rice deficit has been a recurring issue in Nigeria and will only be redressed by harnessing the country's natural resources, namely; land, water bodies, climate and human resources. Bamba *et al*. (2010) noted that Nigeria spends about ₦365 billion annually on Rice importation. In a related development, Ayanwale and Amusan (2012) revealed that the cost of Rice importation has been loss of earnings to the country that could be used in terms of job creation and supporting local Rice production. Numerous factors led to Rice deficit over the years, including increasing population, income growth, staple nature of local Rice and microeconomic conditions (Godwin, 2012).

Thus, local Rice supply response to demand and the changed demand preference of consumers, arising from the need for value for money have been of critical concern to policy makers and other key stakeholders within the Federal and State Ministries of Agriculture in Nigeria (Uchenna and Lioyd. 2018). Local Rice supply response is the

reaction of local Rice producers to changes in price and non-price factors, while local Rice demand preference relates to the systematic ordering of alternatives based on their relative utility (Uchenna and Lioyd, 2018). Generally, the challenge of local Rice has been that of high input cost, low quality and weak competitiveness of local production and policy instability, which makes decision-making and planning uncertain and put investments at high risk (Tomlins *et al., 2005*). These factors combined with discriminatory policies against agriculture to make the local Rice production less interested to farmers (Tomlins *et al*., 2005). Although with the introduction of Agricultural Transformation Agenda (ATA) and ban on importation of Rice the production has appreciated (Qisthy *et al., 2018*).

In response to Local Rice supply deficit and need to enhance the quality and competitiveness of local Rice in Nigeria, government intervened in the local Rice sector by increasing tariffs so that local producers could be motivated. There was establishment of the Federal Rice Research Station (FRRS) at Badeggi in 1970 and National Cereals Research Institute (NCRI) in 1974. This was expected to increase the home market for the nation's local Rice, giving the farmers more income, while creating more employment opportunity. The government implementation of the Commercial Agricultural Credit Scheme (CACS) provided cheap intervention funds that boosted private sector morale to participate in development of the Local Rice sector. A report by Coalition for African Rice Development (CARD) (2015), indicates that about USD 1.67 billion has been invested in the establishment of medium to large scale integrated Local Rice processing mills. Recently, specific supports for local Rice value chain are being undertaken by the development partners. These included the International Fund for Agricultural Development funded Value Chain Development Programme (VCDP),

Africa Development Bank Assisted Agricultural Transformation Agenda Support Programme Phase – 1, on-going in Niger and Benue States, and the World Bank Additional Financing Support to Fadama-III project (Uchenna and Lioyed, 2018).The most current interventions are the on-going Central Bank of Nigeria's Local Rice Farmers' Loan Scheme (Anchor Borrowers Programme for Local Rice farmers), operational in almost all States of the Federation including Niger and Benue and the Growth and Employment in States (GEMS), established 2016 by the United Kingdom Sponsored Programme Partners to boost Local Rice production through linkage with Local Rice mills. The target was to produce 50,000 metric tonnes of local Rice and create livelihood for 25,000 Local Rice farmers. In spite of these interventions, the situation on ground does not reflect the magnitude of stakeholders' commitments to the Local Rice sector, because Qisthy *et al*. (2018) observed that Local Rice production has increase from 5.5 million tonnes in 2015 to 5.8 million tonnes per annum and current Local Rice consumption is 7.9 million metric tonnes per annum. This study therefore attempts to analyse the local Rice supply response and demand pattern in Niger and Benue States, Nigeria.

### 1.2 Statement of the Research Problem

Nigeria is the number one producer of Local Rice in West Africa, and the second largest Rice importer in the world (FAO. 2013).This is because the demand for local Rice outstrips the supply in Nigeria. According to Bamidele *et al*. (2010), Nigeria imports 1.4 million tonnes of Rice, equivalent to 4.8% of global imports and became the largest Rice importer in the year 2007. Similarly, Nigeria spends US$1.3 billion yearly to import 2.2 billion kilogramme of Rice to satisfy home needs (Ayanwale *et al*., 2011). In a related development, Nigeria spent over ₦1billion per day on Rice import to meet the

domestic need (Chukwuka, 2016). Importation of Rice is a major drains on the foreign exchange from the country's foreign reserve and is an indication that the increase in population is not matched by increased in local Rice production and therefore, Nigeria has to import Rice to close the demand and supply gap (Ogazi, 2009).

Given the quality and value of the importation of Rice there is a lot of policy interest in bringing down Rice import by encouraging local Rice production (Ayanwale *et al*., 2011).The supply response of Local Rice in Nigeria and the study areas, may be low due to low producer's price, since consumers prefer imported Rice to local Rice with price difference of ₦75.00 to ₦120.00 per kg ( Uchenna and Lioyd. 2018). Therefore, this research provided answers to the following research questions;

i. What are the socioeconomic characteristics of local Rice consumers in Niger and Benue States in North Central Nigeria
ii. What is the trend in local Rice supply in Niger and Benue States?
iii. How responsive is local Rice supply to changes in price and non-price factors in Niger and Benue States
iv. What is the effect of price on quantity of local Rice demanded and consumers Preference for local Rice in Niger and Benue states
v. What are the consumers' preferences for local Rice and how do local Rice Characteristic affect its price
vi. What are the factors inhibiting the consumption of locally produced Rice in Niger and Benue States in North Central Nigeria

### 1.3 Aim and Objectives of the Study

The aim of the study is to analyse the supply response and demand for local Rice in Niger and Benue States of North Central Nigeria.

The objectives are to;

i. describe the socio-economic characteristics of local Rice consumers in Niger and Benue States, in North Central Nigeria,

ii. analyse the trends in local Rice supply in Niger and Benue States,

iii. determine the responsiveness of local Rice supply to changes in price and non-price factors, in Niger and Benue States,

iv. assess the effect of local Rice price on quantity demanded and consumers' preference for local Rice in Niger and Benue States,

v. determine the effect of local Rice characteristics on its price, and

vi. identify the factors inhibiting the consumption of locally produced Rice in Niger and Benue States.

### 1.4 Statement of Hypotheses

Hypotheses tested in the null forms were,

i. local Rice supply in Niger and Benue States does not vary with price,

ii. local Rice supply in Niger and Benue States does not vary with time,

iii. price has no significant relationship on quantity of local Rice demanded, and

iv local Rice characteristics have no significant effect on price of Local Rice

## 1.5 Justification for the Study

Information on Rice supply response is important in motivating food security because it shows the gap between farmer's supply and consumer demand. Supply response is needed for formulation of different policies; to support the local industry such as the policy to encourage the production of local Rice, bordering on increase access to credit facilities, ban on Rice importation and provision of higher yielding varieties ( Ajijola *et al*., 2012). Supply response of local Rice and demand preference, when estimated, should help to identify possibilities for increasing output. Consumer demand preference when properly determined will help identify the characteristics of local Rice needed by the consumers so that producers and processors may maintain these characteristics. National data on food analysis lacks information on food supply and demand preference of local Rice consumers and the structure of food demand at both local and state levels (Rahji *et al*., 2008). Relevant statistic on supply response and demand preference of local Rice, especially in north central Nigeria, particularly in Niger and Benue States are scanty. This study will furnish policy makers with relevant information on the response of Local Rice supply to price and non-price factors. The study will further reveal information on consumer behaviour bordering on local Rice demand. In addition, information on consumer preference is vital to processors of local Rice in Nigeria and in particular, the North Central region. Furthermore, federal government research institute and stakeholders would be fully informed about the local Rice characteristics that are prefer by the consumers. Study will provide relevant evidence for Rice improvement programs in Nigeria.

The results of this research will be useful to social scientists in the aspect of research initiatives, government in public policy formulation in local Rice production in Nigeria,

Africa and other parts of the world. It will also be of help in technology advancement. Rice breeders may also benefit by breeding the varieties that possess those qualities that consumers want.

# CHAPTER TWO

## 2.0 LITERATURE REVIEW

### 2.1. Concept of supply

Supply is a fundamental economic concept that describe the total amount of a specific goods or services that is available to consumers, supply relates to the amount available at a specific price or the amount available across a range of prices if displayed on the graph (Rao.1988).Supply refers to the quantities of a commodity, services which a seller is willing and able to offer for sale at given point in time. Supply in relation to Local Rice production, is the quantities of Local Rice farmers are willing, able to produce and offer for sale at different prices in a given period of time. (Godwin, 2012).

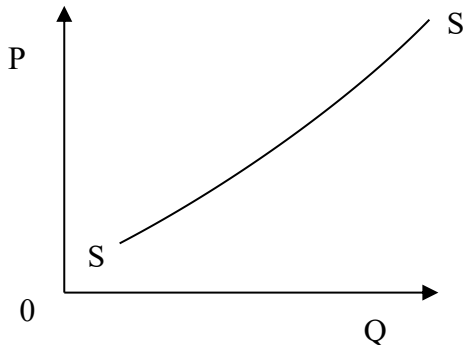



Figure 2.1. Supply curve

Source; Researcher's construct 2017

There are three reasons why price and supply are positively related, these include profit motive; when the market price of the commodity rises, following an increase in demand, it will become more profitable for farmers to increase their production.

Production and cost; when output increases, farmers' production cost raises therefore, a higher price is needed to cover the extra cost of production. (Bamidele *et al.,* 2010), new entrants coming into the production. Higher prices may create incentivefor other producers to enter the production of goods, leading to an increase in total supply (Bamidele *et al.,* 2010 and David.2014).

### 2.1.1 Supply response

Supply responds to output price at the aggregate and at the crop level is consider first. Crop specific Acreage elasticity range between 0 and 0.8 in short run while in long run elasticity is between 0.3 and 1.2 (Rao,1988). Supply response is the variation of output of a product or commodity as a result of variation in price and key inputs (Molua, 2008). Supply decision of a farmer is influenced by price and non-price factors, which may include access to capital, extension services and agro-climatic conditions. Other factors are low agricultural labour, availability of land to be cultivated, low income and use of fertilizer (Kuwornu *et al*.,2011).Supply response may be consider at three different level depending on the type of resources use , these are aggregate agricultural output, commodity composition of output and market supply (Rao,1988).Several conditions may make the farmers to respond to price changes for particular products. These conditions include resource utilization, agro input selection like land or family labour, price of product and farmers' attitudes to risks (Diako *et al.,*2010: Oladimeji. 2017). The bulk of the literature demonstrated that producers are generally responsive to economic incentives. Supply response to price will be scrutinized with view to establishing some general conclusions. Estimation of farmer's response to price changes is important for policy making. When farmer's response is positive to price adjustment, supply is bound to increase.

## 2.2 Definition of Demand Terms

Demand is an economic principle referring a consumer's desire to purchase goods and services and willingness to pay a price for a specific good or services (Rao.1988). Holding all other factors constant an increase in price of a good or services will decrease the quantity demanded and vice versa. Demand for a good is the quantity of

that good which consumers are able and willing to buy at various prices during a given period of time. To have effective demand, the consumer must possess the willingness to pay, ability to pay and must be related to per unit of time, like per day, week, month or year. Demand is a function of price, income, price of related goods, and taste (Jhingan, 2007: Fleetwood, 2014).

### 2.2.1Theory of demand

Demand theory is an economic principle relating to the relationship between the consumer demand for goods and services and their prices in the market (Rao.1988). Demand theory form the basis for demand curve which relates consumer desire to the amount of the goods or services available, as the amount of a good or services is available demand drop and so does the equilibrium price. Demand theory postulates an inverse relationship between the price of the good and quantity demanded. When the prices fall, demand for the commodity increases, but a rise in price leads to reduction in quantity demanded of the commodity. Consumers' switch away from a rival product as price falls towards the commodity with willingness and ability to buy more of the commodity, since the opportunity cost of purchasing the commodity falls (Jhigan. 2007). The theory refers to the direction in which quantity demanded changes with a change in price. This explains the negative slope of the demand curve. The inverse price demand relationship holds with the *ceteris paribus* assumption. The assumptions governing the law include the following: (i) there is no change in the tastes, preferences, income and customs of the consumer; (ii) the commodity has no substitutes, confer distinction, while the price and quality remain constant with no change in the price of other products. Any alterations in these conditions make the law invalid (Jhigan, 2007)

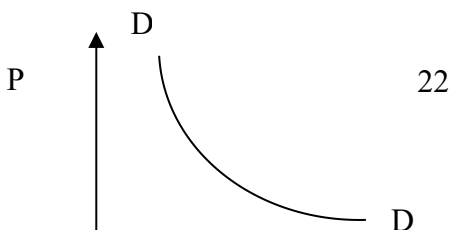


Figure 2.2 Demand curve
Source; Researcher's construct 2017

### 2.2.2 Revealed preference of theory of demand

Revealed Preference theory is a method of analysing choice made by an individual, mostly use for comparing the influence of policy on consumer behaviour (Samuelson. 1948). It assume that the preference of consumer can be revealed by their purchasing habit, revealed preference theory arises because existing theory of consumer demand were based on diminishing marginal rate of substitution (MRS).This (MRS) relied on the assumption that consumer make consumption decision (Samuelson 1948). While utility maximization was not a controversial assumption, the underlining utility function could not be measure with great certainty. Revealed preference theory reconciles demand theory and defining utility function by observing behaviour, it directly measure preference on utility. The theory is based on the relationship that exists between consumption of goods and the utility, which is the satisfaction derived from goods. The goods are needed for expected satisfaction (Shittu, 2003;Munoye, 2016). Researchers believe that the theories of consumption are in three stages. These are the (i) Cardinal utility theory, which was based on the principle that value depends on the utility derived. The cardinalists postulate that consumers make decisions rationally and that utility can be measured, where marginal utility for money is fixed; (ii)the total utilities is associated with diminishing marginal utility, and (iii)ordinal utility theory, which says

that what is important is the shape of the indifference curve. The theory further postulated that since the consumer has limited resources, rational choice has become very imperative with revealed preference. This means that if commodity A is preferred to B and B preferred to C, then A must be preferred to C. Since the consumers are not certain of all the characteristics of the goods, two commodity bundles have to be compared to be consistent in choice, (Shittu. 2003).

### 2.3 Measurement of demand

Demand is measured using elasticity. Elasticity could be measured using various methods such as percentage, point, arc and total outlay. The degree to which the demand changes due to changes in prices is called demand elasticity. The degree of changes differs and depends on whether the commodity is normal or inferior. Normal goods are those goods that their consumption increases with increase in income, while inferior goods are commodities that their consumption decreases with increase in income. Commodities that are essential to consumers for example, commodities that are necessities are price inelastic, this is because consumers still buy them even at increased prices. Inferior goods are price elastic because they have higher opportunity cost (Akanni and Okeowo. 2011; Anwarul Huq and Fatima.2017).When a slight change in price of goods leads to greater change in quantity demanded, it is said to be price elastic. However, inelastic good is the one in which change in price leads to smaller change in quantity demanded, if there are any changes at all (Zeigler. 2012).

#### 2.3.1 Income elasticity of demand

This is a proportionate change in quantity demanded as a result of a change in the incomes of the consumers**.** It is the ratio of percentage change in the quantity demanded of a commodity to the ratio of percentage change in the income. The coefficient may be positive, negative or zero, depending on the nature of commodity**.** For normal goods, income elasticity is positive, negative for inferior goods and zero for necessity goods (Shittu. 2003; and Munonye.2016).

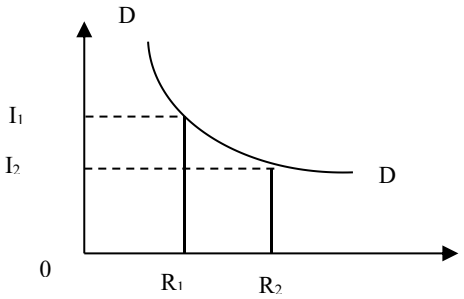



Figure 2.3. Income elasticity of demand
Source; Researcher's construct 2017

### 2.3.2 Price elasticity of demand

Price elasticity of demand is the reaction of buyers to price changes. The price elasticity of demand is the ratio of the percentage change in the amount demanded to the ratio of percentage change in price. When a commodity has many substitutes, the more elastic the demand for that commodity will be (Shittu. 2003: David.2014). The price elasticity is divided into own price and cross price elasticity of demand. Cross price elasticity of demand may be positive for substitute goods and negative for complementary goods, while own price are mostly negative. If two commodities are complementary, a rise in the price of one leads to a fall in the demand for other.

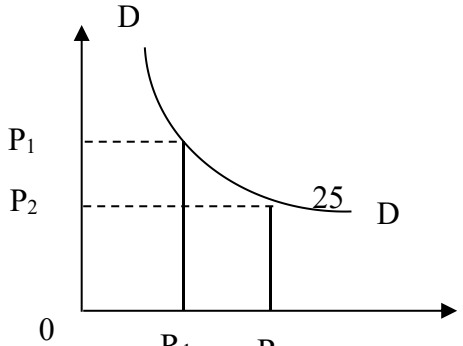


Figure 2.4 elasticity of demand
Source; Researcher's construct 2017

## 2.4 Techniques for Demand Analysis

Estimation of demand system enables decision makers to have good idea of consumer behaviour. Ideas from estimation, give policy makers and marketers bases for decision on measuring consumer behaviour parameters. The procedure for measuring consumer behaviour includes (i) selection of consumer bundle for utility maximization and (ii) measurement of consumer demand, using linear expenditure system and the Almost Ideal Demand System (Fedderke,2000 )

i. Selection of Consumer bundle for Utility Maximization

Consumers select the consumption bundle to maximize utility, subject to budget constraints. Several theoretical models are in use when estimating consumer demand functions. These are the linear and log linear models. Sinha (1997) was among those that used these approaches. Restrictions based on the theory of demand for these models are (i) equality of expenses and income; (ii) equal changes in income and price but with no effect on quantity of goods bought; (iii) with increase in price, less goods should be demanded; and (iv) the matrix substitution of demand must be the same.

ii. Linear Expenditure System (LES)

Literature on linear expenditure system got its origin from Stone (1959), with the estimation of complete demand system. Klein and Rubin (1947) introduced the linear expenditure system with the formulation of the linear demand equation for which restrictions were imposed following demand theory. The disadvantage of LES comprise

s restrictions of proportional income, elasticity of price and disregard for complementar y relationships between commodities. These limitations motivated the development of other models, which included Translog demand system.

iii. Linear appropriate Almost Ideal Demand System (LA/AIDS)

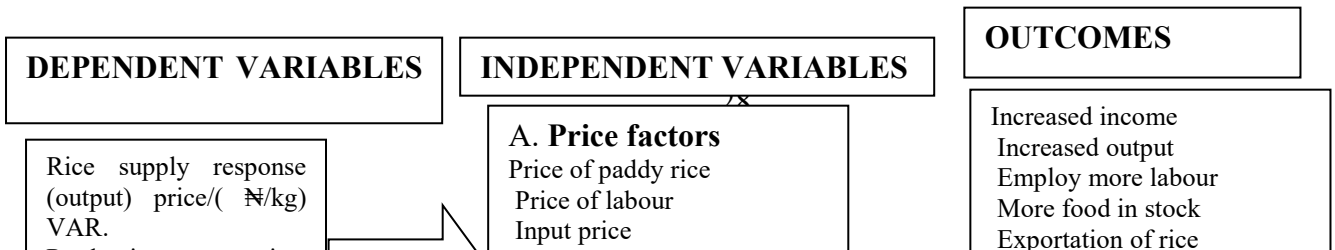
This model has many desirable theoretical properties but usually it is estimated using a linear approximation. The quality of the approximation to the true AIDS depends on the parameters and the co linearity among the exogenous price variables. According to Blanciforti *et al.* (1986) there are basically two approaches when trying to estimate demand system, the first approach start with utility function that satisfies certain axioms of choice. Demand function can then be obtained by maximizing the utility function subjected to a budget constraint. The majority of demand function estimated uses this approach. An alternative approach, and the one chosen to apply in this study, starts with an arbitrary demand system and then imposes restrictions on the system of demand functions. Almost Ideal Demand System (AIDS) was proposed by Deaton and Muellbauer (1980). It has wide range of applications and has been used extensively. This was proposed as an alternative model to the earlier Translog demand model. This model satisfied the axiom of choice aggregates over consumer choice. It allows restriction of budget data of the household to be taken into account during estimation. It is a cost minimization model and easy to apply.

## 2.5 Theory of Change and Conceptual Framework for Supply Response and Demand 0f Local Rice

The theory of change explain the process of change by outline casual linkage in an initiative, short time, intermediate and long-time outcome (Clack and Taplin, 2012).The identified changes are mapped as the outcomes pathway showing each outcome in logical relationship to all others as well as chronological flow. The links between

outcomes are explained by rationale or statement of why one outcome is thought to be a prerequisite for another (Chris, 2011). The innovation of theory of change lies in making the distinction between the desired outcomes before decide of forms of intervention to achieve those outcomes (Chris, 2011). Theory of change focused not only generating knowledge about whether a programme is effective but also on explaining what method is used to be effective (Chris, 2011) The conceptual framework was constructed following the theory of changes guiding the study.

The conceptual framework was conceived based on the supply response, which is output response to change in price and non-price factors of the product. This shows clearly the dependent, independents, intervening and outcome variables (figure 2.9). Expectations are that supply responds to price and non-price factors given the intervening variables. With increase in price, supply of rice is bound to increase given the nature of the commodity and vice versa. Especially through intervening variables like government policies (ban on importation, quota system, heavy taxes on importation, tax holidays and even programmes) social factors and bio-physical factors. Thus, it is expected that local Rice will now maintains higher qualities that is likely to attract many consumers. The cumulative effects are likely to come as outcomes of these interaction or linkages, which could manifest inform of increased income through increased production and demand. Many are likely to become employed through processing and retailing outlets, while Rice becomes available for the nation to export to generate revenue. The scenario revolves on self-reliance of the nation, food security becomes the cardinal figure that raises the standard of living and increases the welfare of the citizen.



AIDS Model

Hedonic Model

**Hedonic Model**

⇩

**Kendell's Model**

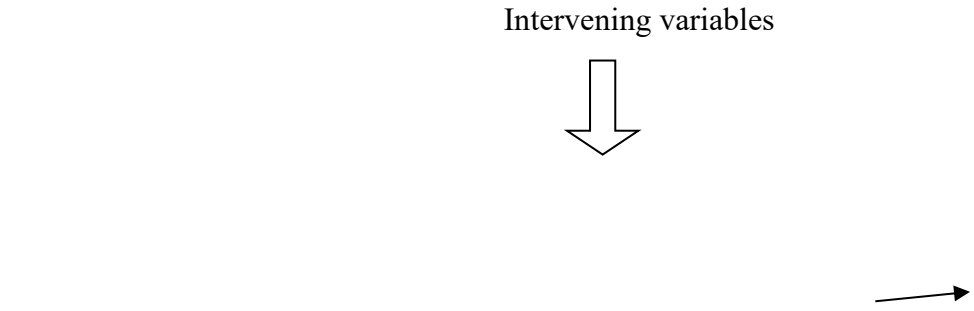



Figure 2.5 Conceptual framework of supply response and demand preference of Rice
Source; Researcher's construct 2017

### 2.6. Review of empirical studies on supply response

In the study of analysis of aggregate output supply of selected food grain in Nigeria (Akanni and Okeowo.2011). Revealed the male constitute 80% of the respondent and gender has great effect on food supply. The study revealed an all-time maximum output of 8,090, 000 tonnes for local Rice followed by millet with 7,100,000 tonnes with mean values of 4,228,900.47: 4477, 026.30: 3,596,894.73 and 2,034,719.00 for maize, local Rice, millet and sorghum respectively. In the study of yield response of local rice in Nigeria: A co-integration analysis David (2014) revealed that increasing yield levels for paddy local Rice in Nigeria and ensuring stability requires interplay of biophysical, socio economic and structural forces. David (2014) opined that estimate for the current study, bridging of demand supply gap can be neutralize initiations of measures to address inefficiencies in the supply chain to ensure appropriate transmission, price increment, promotion of local Rice consumption to ensure ready market for farmers in terms of increasing output.

In supply response of potato in Bangladesh: A Vector Error Correction Approach used by Anwarul and Fatima, (2017) observed that the short run price elasticity was 0.45 while the long run elasticity was 0.62, price policy are effective in obtaining the desired level of output for potato. If intervention in the market is of necessity, then it must be implemented during the harvest season for altering price expectation. Study on household's consumption preference for imported and domestic Rice in Kaduna State, Oyinbo. (2014) revealed that the males constituted 83% of the respondents, while gender was noted to have great effect on food consumption patterns of sampled households. This agrees with the findings of Agboola. (2013), who argued that gender significantly affected food grains, dairy products and rice by products consumption in South Africa.

In a study on the economic analysis of local Rice consumption patterns in Nigeria, Bamidele *et al*.(2010) opined that the educational status of the household heads had effect on the choice of Rice to be fed to the family. Those that had higher level of education preferred the imported Rice. This may likely be due to the higher quality of imported Rice. However, other households may like local Rice due to its higher raw nutrient contents. A reasonable number of the household heads attended at least primary education. The study further revealed that occupation determined the consumers' income levels, while income determined the household level of consumption. Majority of respondents had farming as their primary occupation, while few had trading and civil service jobs as their main occupations. The study also observed that the size of the households had great influence on the type of Rice consumed. As the family size increased, the quantity of local Rice consumed also increased. Almost three-quarter of the respondents had family sizes of 9 persons and the remaining had between 10 and above persons. The average family size of the respondents was six, while the modal class range was 5-9 persons per household.

Similarly, Kassali *et al*. (2010) in the study of demand for Rice in Ile Ife, Osun State, Nigeria, showed that majority of the respondents were females. This signified that women were mostly the household decision makers on consumption issues. The study observed that respondents were involved in different occupations, ranging from teaching, farming, craftsmanship, trading to public civil service. More than half were civil servants, while the rest were involved in the other occupations. The large proportion of civil servants was as a result of a Federal University located in the

community, and the presence of government owned organizations like High Court and Ife Central Local Government.

Kassali *et al*. (2010) also found that the incomes of the household heads ranged from low to medium and high income earners, based on ₦18,000 minimum wage of the Federal Government of Nigeria. Those that earned higher per month were few. The study also showed that expenditure increased as the household size grows. This means that more were spent on consumption as the number of family members increased. As the family size increased from 2 to 14 people per household, average food expenditure in turn increased from ₦ 8,740 to ₦ 16,200 per month, thus, the income class of respondents determined their monthly food expenditures.

### 2.6.1 Approaches to the measurement of supply response

In agriculture, the observed prices are known after the production has occurred, while planting decisions are based on the prices expected to prevail later at the harvest time. Because of this time lag, price expectation plays a key role in supply response analysis. Measurement of supply response is widely used to enable the analysts and decision makers get better understanding of producer behaviour. Information from this measurement will enable the marketers and policy makers to base decision on quantified producer behaviour parameters. Reviews of the various models previously used are detailed below:

(i) Nerlove Expectation Model: The models formulated and used by Nerlove, (1958) tomeasure supply response were the adaptive expectation and partial adjustment models

a. Adaptive expectation model

$A_t = \alpha_0 + \alpha_1 P^e_t + \mu_t$ (1)

$P^e_t = P^e_{t-1} + \beta(P_{t-1} - P^e_{t-1})$ (2)

$0 < \beta \leq 1$

Where;

$A_t$ = Actual acreage in year t

$P^e_t$ = Expected price in year t

$P_{t-1}$ = Actual price in year $_{t-1}$

$P^e_{t-1}$= Expected price in year $_{t-1}$

$\alpha$'s = Structural coefficients

$\beta$ = Adaptive expectation coefficient

$\mu_t$ = error term

From the above equation, the hectarage covered is assumed to be based on certain price from onset of planting when the price is not known. Expected price is predicted, Nerlove used predicted price to postulate a hypothesis that the expected price in a given year is a function of the expected price in the past year and the difference between the actual and anticipated price in the past year. The coefficient of the model takes a value between one and zero. The value of one means expected price and actual price of the past year are the same. A zero value suggests that expected price adjusts period by period.

Critique of the Adaptive Expectation Model

Adaptive expectation needs series of data on expected price; where these are not available, it cannot be measured. Errors in future cannot be corrected in prediction by the farmers.

b. Partial adjustment model

$$A_t = \alpha_0 + \alpha_1 P_{t-1} + U_t \quad (3)$$

$$A_t = A_{t-1} + (1-\lambda)(A^*_t - A_{t-1}) \quad (4)$$

$$0 \leq \lambda < 1$$

Where;

$A_t$ = Acreage in year t

$A^*_t$ = Proposed acreage in year t

$P_{t-1}$ = Price in year t-1

$\alpha$'s = Coefficients

$\lambda$ = Partial adjustment parameter

$U_t$ = error term

Here, the proposed hectare in a given year is a function of the price for the past year and external variables. The partial adjustment theory is the re-model of the proposed hectare by using observable parameters. The partial coefficient is between zero and one. Value of one, indicates collapse of theory and value of zero shows that achieved hectare is equal to proposed hectare, year by year. In this case, farmers are not given opportunity to correct their error (Lim, 1975).

In agricultural supply response analysis, there is a wide difference between the proposed and actual output. This is because hectare is used as proxy for output, and farmer have no control over the factor that pre-empts the real output. These factors could be rainfall, temperature, diseases, drought and flood (Tyagi, 1974)

Critique of the partial Adjustment model

Supply response has been measured using Nerlovian models, but no conclusion has been made if farmer makes any expectation about the price as suggested by the model. There is ignorance of formulation of decisions in response to changes of any kind

(Tyagi, 1974). Farmers produce not only for sale but for their consumption, this leads to negligence of needed data for the study of supply response (Behrman, 1968). The knowledge of how farmers form the decision on how to respond to changes in prices in production is lacking (Tyagi, 1974).

(ii) Griliches input demand approach

Grilliches (1959) used input demand elasticity in measuring supply response, using constant return-Cobb-Douglas production function. This approach was used in developed countries. The problem with Griliches approach is the data requirement for inputs and output prices. Griliches approach is not suitable for poor countries because of extensive data requirement on agricultural input and output.

### 2.6.2 Local Rice in Nigeria

As far as local Rice is concern in Nigeria the word local Rice in this study only refers to locally grown rice in any part of Nigeria. The locally grown popularly called by where the Rice is cultivated. In Nigeria there are locally grown rice called Ofada Rice in south, Abakaliki Rice in south East, Mokwa Rice, Kwakuti Rice and bachita Rice in the North central. Locally grown rice are unpolished also called brown Rice containing more nutrient than the polished Rice. Local Rice maintains the name whether improved or local variety provided it's grown and process in Nigeria. Local Rice is very rich in carbohydrate, it help in digestion because of its high fibre content. Local Rice carry different name depending on the locality, it could be upland, lowland, hydromorphic and deep water local Rice. Some of Nigerian local Rice are shown in the picture below.

**Plates of local Rice found in markets**

Kwakuti local Rice .i

Mokwa local Rice ii

Ofada local Rice iii

### 2.6.3 Trend of local Rice supply in Nigeria

Local Rice production in Nigeria has passed through changes with concurrent population increase; however, supply is yet to meet domestic demand. Policies adopted included increased production through innovations, in spite of this, supply is yet to close the demand gap ( CBN. 2014). Onu *et al*.(2015) observed the trends of local Rice supply in Nigeria and noted that 60.1 million metric tonnes of local Rice was produced between 1980 and 2013.The mean quantity of local Rice produced in Nigeria was 5.587 million metric tonnes (figure2.10). This result shows that there was difference in growth between 1980 and 20l3.The growth rate of local Rice production ranges between 2.73% as minimum in2000-2004 and 9.49% in 1985 and 1989 as maximum. The total average growth rate of local Rice production between l980 and 2013 was 31%. The growth rate of localRice production in Nigeria between 1980 and 2013 was very low.

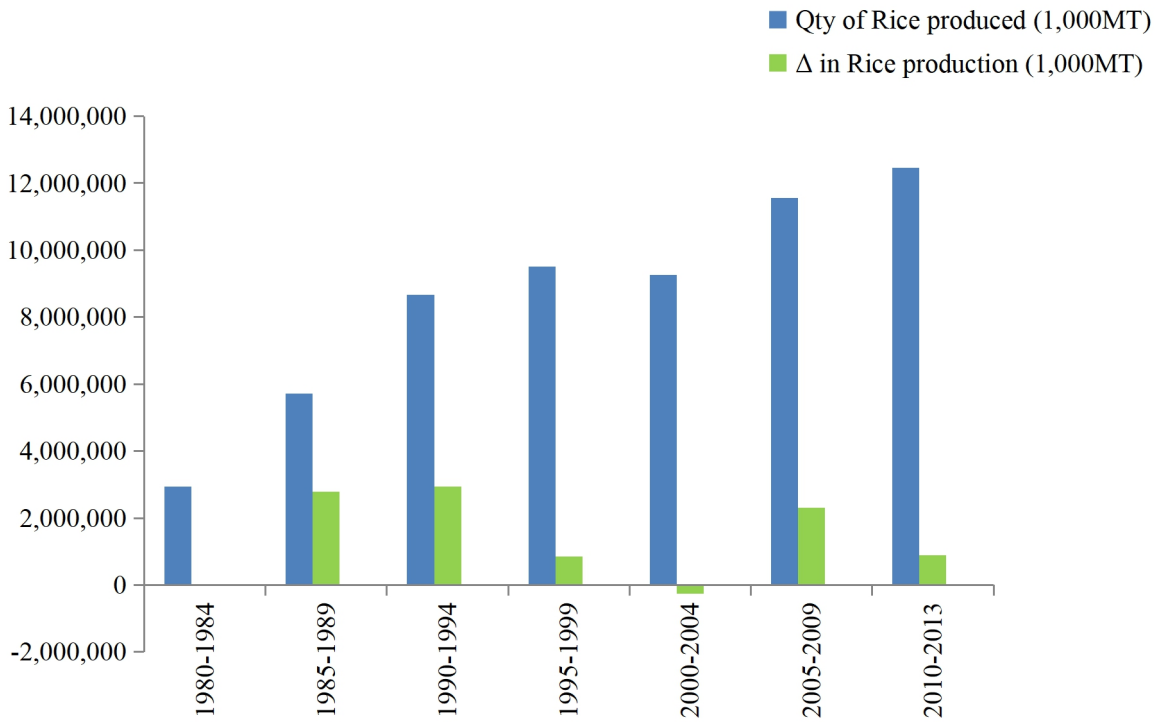



Figure 2.6.Trend of local Rice produced in Nigeria 1980 - 2013

Source: Researcher's construct using CBN data

The trends of local Rice showed changes from 1980 – 2013, local Rice production increased and decreased in years. Between 1985 and 1994, production increased to 8,662,000 when compared to 2,937,000 different from previous production. In year 2004, percentage change in local Rice production became negative. The production picked up in 2005 – 2009 and change in production stood at 2,303,000 but decrease to 894,000 in 2013.

Rahji *et al.* (2008) revealed that the growth of total output and area cultivated of local Rice were positive. From 1967-1985, yie1d response was positive before the ban onRice importation and negative during the ban. Between1967 and 2004, area cultivated

and yield dropped by 7.4%. The contribution of area cultivated was up to 77% and yield was 30%. Between 1986 and 2004, area cultivated contributed 225% of total output, and yield dropped to 107%. Similar study by Oyakhilomen *et al*. (2015) showed that the 36 year trend variables were significant at 1% level of probability and all relationships appeared positive. The co-efficient of 0.65 for the supply also recorded 6.5% increase in the supply of local Rice during the study period. The growth increase was 6.5%, which meant that during the period of 1970-2011, the increase was very small compared to2.9% population growth annually. The study concluded that since the demand was 7.5% and supply was 6.5%, growth in supply was less than the domestic demand. The finding also agrees with Ojoehemon *et al.* (2009) who concluded that both production and consumption had increased.

### 2.6.4 Local Rice supply response

Agricultural contribution to the economy depends on how well the producers respond. The producer could respond to price change and non-price factors. In Nigeria, the response of local Rice supply to price is mostly low Kassali *et al.* (2010) However, local Rice supply responds very well to bio - physical factors (Rahji *et al*., 2008). For instance, local Rice supply responds to rainfall, area expansion and fertilizer utilization. Rahji *et al*. (2008) observed that local Rice growth output is because of area planted and policy intervention. The study further established that the short run and long run price elasticities of local Rice were inelastic because they were not up to one. The co efficient and speed of adjustments were low. As such, measures that pilot adjustment are indications of increase production. Similarly, Ogazi (2009) used error correction version of auto regression distributed lag model to estimate output of local Rice supply response to the change in real price in Nigeria, and observed that the supply response of local

Rice was not elastic in both the short and long runs. This inelastic effect means local Rice producers were not responsive to price (Ogazi, 2009). This is not unconnected to the fact that Nigerian local Rice farmers produce for their families, and only little or none for sale. As such, do not take cognisance of price mechanism. What mostly determined output supply response of local Rice for both short and long runs were weather factors. The estimated coefficient of long run price elasticity was 0.271, which is inelastic. This implies that with low supply response; farmers may be facing some problems (Ogazi, 2009).

Ayanwale *et al*. (2011) worked on local Rice supply response in Nigeria and found that in the long run, area cultivated was insignificant and fertilizer was significant at 10% level of probability. The study reported that local Rice supply did not respond to price, importation and trade regulation policies, but only to area cultivated and fertilizer utilization. The non-response of local Rice supply agrees with the work of Rahji *et al*. (2008) and Muchapondwa. (2008). However, the short run indicated that the area cultivated was important in local Rice supply in Nigeria. The coefficient of land was significant at l% level of probability and fertilizer was significant at 5%.

Yield response of local Rice was low in Nigeria due to low use of important inputs such as fertilizer, pesticide, extremely low mechanization of local Rice farm, Rice farmer's over reliance on rainfall. Other problems were wrong use of farm management practices, irrigation facility, inadequate labour supply to carry out important cultural practices like weeding, pest control, use of local seed materials, low prices in the output market and small number of extension personnel (David. 20l4). West Africa Rice Development Association,(2003) observed that growth increased was statistically significant, but that

such increase may not be enough to increase farmers' incomes. This may not provide the opportunity of meeting the decision of equating demand with supply of local Rice. WARDA. (2003) further observed increase of yield by 0.20% and 0.47% for short run and long run respectively for 1% increase in real producer price of local Rice. Ogazi, (2009) reported 0.043% and 0.27% as price coefficients for the short run and long run respectively. Based on these coefficients, the yield response in the study was inelastic. The study observed that farmers were facing problems of non-price factors like inadequate market structures, limited access to credit, low water supply, low labour supply and high cost of chemicals, which accounted for great share of cost of production in local Rice. These prevented most farmers from responding to non-policy incentives that may increase local Rice outputs.

**2.7 Effects of Local Rice Price on Quantity of Local Rice Demanded**

However, responses to price changes depend on the nature of the commodity, for example, whether it is a necessity or inferior. The demand for necessity commodity like local Rice does not change much with rise or fall in prices this is because people must eat. Similarly, decrease in the price of local Rice will not cause much increase in consumption. In case of luxury food, increase in price leads to major reduction in consumption. The priori expectation is that when the price of local Rice increases, the consumer reduces the quantity that will be demanded, and thus, a negative co-efficient of local Rice. On the other hand when income of consumers increases, the quantity demanded of local Rice must increase being a normal good (Omonona *et al*., 2010).

Studies of Kassali *et al.* (20l0) and Hassan, (2017) show an inverse relationship between the quantities of local Rice demanded and price at10% probability level. This

means that, as price of local Rice increases, the quantity demanded of local Rice decreases. The study showed that I % movement of price of local Rice will change the quantity demanded of local Rice by 1.77%. From the result, price elasticity of local Rice was negative, but greater than 1, implying that a small increase in price of local Rice will lead to greater fall in demand, hence local Rice is price elastic. The negative sign shows that 1% increase in price of local Rice will decrease local Rice quantity demanded by 1.77%

The study of Oyinbo *et al.* (2014) showed that the price of local Rice was positive and significant at 1% probability level, meaning that 1% increase in the price of local Rice raises the proportion of household expenditure on local Rice by 0.0095%. This was however, contrary to the findings of Omonona *et al*. (2010) who found that the price of local Rice was negative to household spending. The expenditure elasticity estimated was less than one, meaning that local Rice is not a luxury but necessity. However, compensated price and cross price elasticities of local Rice were higher than the uncompensated price elasticity. The result was contrary to the findings of Erhabor and Ojogbo. (2011) revealed the compensated elasticity of local Rice, was higher than the uncompensated elasticity. The compensated price elasticity of local Rice by Oyinbo *et al*. (2014) was similar to the uncompensated price elasticity in study of Omonona *et al*. (2010) and both were inelastic and negative. Erhabor and Ojogbo (2011), established that local Rice is a normal good and expenditure inelastic. That is, a unit increase in household income will increase the demand by less than unit. This outcome was contrary to the findings of Omonona *et al*. (2010) which revealed that local Rice is inferior commodity.

The findings of Omojola *et al*. (2006) showed an inverse relationship between quantities demanded and price changes. They concluded that demand for local Rice was price inelastic. This is because many consumers did not want to leave eating local Rice because of increased price. They only reduced the quantity demanded.

**2.8 Effect of Local Rice Characteristics on Price**

Local Rice grain qualities or characteristics are important among local Rice consumers in Nigeria. Consumer's choice of local Rice is always guided by taste, price of local Rice, convenience, variety, as well as quality (Tetteh et *al*., 2011). A study conducted by Opeyemi *et al*. (2015) revealed that the taste of local Rice was significant to the consumers, with higher price paid for it. The work of Ahmad *et al*. (2011) used Lancasters theory (1966) to argue that consumers derived satisfaction from the characteristics of goods, not from goods consumed. In the result, food safety, tastes and size of the grain were ranked first, second and third in importance, respectively. Ahmed *et al. (*2011) observed that consumers want regular supply of local Rice and reported positive utility (satisfaction) for conventional Rice. The fragrant Rice and brown Rice (imported Rice) were of high quality and higher price.

Another attribute which was considered with local Rice, when compared with imported Rice, was satisfaction derived from it. Consumers derive low satisfaction (utility value) from local Rice, but cheaper than imported Rice. This finding agrees with Onu*et al*. (2015) and Schobesberger *et al.* (2008) who observed that food safety is significant and should be one of the qualities that should be considered for grain. The study conducted by Ahmed. (2011) observed three characteristics to be considered namely; short grain local Rice with low utility value followed by medium local Rice and long grains local

Rice that has the highest utility values respectively. The imported Rice has highest satisfaction and more preferred but expensive. Their patronage may be low due to high price. A study conducted by Gideon *et al.* (2014) found that factors that affected the use of local Rice were poor packaging, poor texture and unattractiveness to the consumers. The last factor was the price, which implies that consumers were ready to pay high prices for attractiveness and quality of the commodity. Opeyemi *et al*. (2015) observed that the price of locally produced Rice was very low due to poor quality. The study revealed that consumers ranked stone free Rice "first" to be the reason why they prefer imported Rice.

Olurunfemi. (2014) revealed that consumers preferred local Rice without foreign matter as the first criterion, followed by whiteness. Price was the least, indicating that consumers were ready to pay high prices for clean local Rice that is of high quality. Gideon *et al*. (2014) observed that local Rice is of poor quality and that was why Ghanaians prefer imported Rice (fragrant, brown and organically produced Rice) to locally produced Rice, largely because imported Rice is free from foreign materials and has better grain quality. Moreover, Nwanze*et al*. *(*2006): Tomlins *et al*. (2005) opined that consumers in Africa have much interest in grain quality and are ready for higher quality local Rice.

**2.9 Factors inhibiting the Consumption of local Rice**

Gideon e*t al*. (2014) used Kendall's coefficient of concordance to rank the prohibiting factors of locally produced Rice in Ghana. Poor packaging of local Rice was ranked first. Other inhibiting factors were poor texture and unattractiveness, ranked second and third respectively. The last was the price of local Rice, which mean consumers were

ready to pay higher when the qualities of local Rice is maintained. Oyinbo *et al*.(2014) opined that households preferred imported Rice to local Rice, while factors that significantly influenced households Rice consumption preference was Rice quality. The study further revealed that poor qualities like presence of stones, unclean local Rice, poor packaging, and broken grain inhibit the use of local Rice in Nigeria. This is in line with the study of Opeyemi *et al. (*2015) that attributed patronage of imported Rice to its milling quality.

**2.10 Approaches Proposed for the Study ( OLS & VAR )**

This study employed the method of co-integration, thus implying the use of ordinary Least Square (OLS), which is linear least square method for estimating the unknown parameters in a linear regression model. OLS chooses the parameters of a linear function of a set of explanatory variables by the principle of least square: minimizing the sum of squares of the differences between the observed dependent variable (value of variables being predicted)in a given data set and those predicted by the linear function.

**2.11 Unit root test**

Stationary data refers to data with constant mean and variance. Stationary series move around its mean value, finite range without showing a distinct trend over time. Displacement over time does not change the characteristics of a series in stationary data. Probability distribution also remains the same over time (Mohammed, 2005). For instance,

$$Y_t = \theta Y_{t-1} + \mu_t \qquad (5)$$

$\mu_t$ is a random variable having mean zero and constant variance. If $\theta < 1$, the $Y_t$ series is stationary and if $\theta = 1$ then $Y_t$ series is non stationary. This shows that the mean,

variance and covariance of series $Y_t$ change as time changes. $Y_t$ can be made stationary by differencing, which can be done many times on series, depending on the number of unit root a series has. When a series becomes stationary after differencing d times, the series had d unit roots and integrated of order d written as *I*(d). In equation (seven), where $\theta = 1$, $Y_t$ has a unit root.

As an important stage in co-integration, the data collected has to be checked for stationarity of each series and to be sure of order of integration of each series. Hansen: Juselius (1995) and Hair *et al.* (2010) pointed out that for co-integration to prevent spurious result; all the series considered should have the same order of integration, mostly *I*(1). This study will use the Augmented Dickey Fuller (ADF) test as adopted by Ogazi (2009). This means using a regression stated as:

$$\Delta Y_t = \beta_1 + \beta_{t2} + \delta Y_{t-1} + \sum_{t-1}^{k} \alpha_t \Delta Y_{t-1} + \varepsilon_i \qquad (6)$$

Where:

$\Delta$ = Change;

$Y_t$ = Variables (Price of local Rice, Output of local Rice, Quantity of fertilizer used, Hactarage of area cultivated, Amount of rain recorded, Policy interventions) under investigation for stationary.

$Y_{t-1}$ = Past values of variables

$\Delta Yt\text{-}1 = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$

t= time variable and

$\varepsilon_i$ = error term

Existence of unit root in $Y_t$ agrees with null hypothesis $\delta = 0$, that is, non-stationary series**.** When the value of ADF statistic is less than critical value, it means $Y_t$ is stationary ***(Y~ I(0))*** and if is greater than critical value $Y_t$ is non-stationary and null will

be rejected. Differencing at first level means the series is non-stationary at level and may be stationary at first difference *I*(1).If is not, it may be differenced several times depending on the level of non-stationarity.

### 2.11.1 Co-integration analysis

In supply response research, co-integration estimation continues to play much role with the help of Engle – Granger two step estimation method (Engle and Granger, 1987). Several approaches of testing co-integration in existence, these include; Engle and Granger single equation approach, Durbin Watson test, multiple equation approach which comprise of DF, ADF and Johansen full information maximum likelihood test. The ADF was used this was selected because it permits all possible co-integration relationship and show practical determination of the number of co-integrating vectors (Kuwarnu *et al*., 2011). It also provides guides for short run coefficient to be consistent with long run relationship. Co-integration is to find out long-run relationship between variables, and how long-run equilibriums variables are co-integrated. Co- integration is possible in two ways, the series for the two individual variables must be integrated of the same order and linear combination of the variables must occur, that is integrated to the order lower than the individuals. Put in another way ,level variables must be individually *I(1)* which is dominated by long-run components but the linear combination of these *I(1)* variables must also be *I(0).* This means, the long-run components of these series cancel each other out to exist in a stationary series, and those variables are said to be co integrated, For example

$$K_t = \alpha + \beta\gamma_t + \mu_t \qquad (7)$$

When the series $K_t$ and $\gamma_t$ are both *I(1)* and the error term $\mu_t$ is *I(0)* then the series are co integrated of order *I(1,0).* In above equations, β measures the equilibrium relationship

between the series $K_t$ and $\gamma_t$ and $\mu_t$ is the difference from the long-run equilibrium. In co-integration, when variables move for long period and are linked together to produce equilibrium relationship, even if themselves are non-stationary but they move together or closely over time and their variations are constants, like $K_t$ and $\gamma_t$ it means they are stationary. So the theoretical meaning is the long-run equilibrium to which an economic system goes over period and $\mu_t$ is taken as the equilibrium error or differences that occurred in the relationship.

### 2.12 Measurement of Demand Preference

Demand preference measurements are used by researchers and decision makers to categorize consumer's behaviour. The ideas from the measurement, helps the producers, policy makers and even commodity marketers to come up with scale rating of consumer's behaviour parameters. These measurements include (i) demand function model and linear expenditure system

**i. demand functional model (DFM)**

Under this measurement approach, consumer select consumption bundle with the highest satisfaction, considering the budget at their disposal in estimating the demand function. The theoretical model used comprises the log linear and least square (Butt, 2010).

**Condition for the application of demand model**: The demand for good is inversely proportional to its price with more commodities demanded when the price is low. Total income of consumer is the same with its total expenditure on goods and when changes in income and prices are the same, it has no effect on quantity bought.

**ii. Linear Expenditure System (LES);** This procedure entails minimizing the sum of squared residual over all expenditure equation and time periods. It needs no a priori specification of the error structure. Klein and Rubin (1947) imposed the restrictions of demand theory on a linear demand equation. Stone (1954) provided the literature of linear expenditure system used for the estimation of complete demand system.

**Critiques of DFM and LES models**

i. It does not rest on a specification of error structuring and the properties of the measurement are not known.

ii. It has restriction on income and elasticities, disregarding complementary relationship among goods and exchanging necessity for luxury goods

**iii. Contingent valuation (CV) and Con-joint Analysis (CA)** these have also been used to measure demand preference. CA was used in many studies (Baker 1999, Babicz-Zielinska and Zagorska 1998; Ahmad *et al*. 2010). Basically, CA tried to investigate how respondents established interest for local Rice characteristics (Hair *et al.,*2010). The first step in conjoint analysis is to establish the characteristics and level of characteristics to be included in questionnaire. Some of the methods used to establish these characteristics were literature, focus group sessions and interviews. The purpose was to establish the factors that led to the purchasing of local Rice while information is collected on most consumed local Rice which will be suitable for CA study and CV is to measure the value in naira.

**Critique of the CV and CA models**

The method has been viewed as unrealistic given the need to ask individual their intention to purchase for too many scenarios. It could also be very tiring and time consuming (Murphy *et al*., 2004).

iv. **Logistic model**

Logistic model is also used in establishing consumer preference for food including local Rice. The Logit model permits summation of mean of dependent variables or elasticity, thus, providing the measured coefficient of the regressors'. Consumer preference for local Rice or not will be shown by taking note of socio-economic characteristics or factors in the Logit framework. Here, preference for local Rice or does not matter but the probability of the outcome. The model is binary response, with preferred for local Rice taking as ''success'' while none preferred is taken as ''failure.''

Y is a random variable (Dichotomous) and Y either takes the value of 1 or 0. Where value of 1 stands for occurrence and 0 stands for non-occurrence of the event. $X_1 \ldots\ldots X_p$ refers to occurrence of the outcome.. The logistic model specifies that the conditional probability of event which may be Y =1 gives the values of $X_1 \ldots\ldots X_p$

$$P_1 (Y_1 = 1/_{x1\beta1}) = 1- e^{x1\beta}) = e^{x1\beta}/(1+ e^{x1\beta}) \quad (8)$$

The binary logistic regression model is written as:

$$Yi = 1\text{-}f (x_1\beta) +\varepsilon_i \quad (9)$$

Where Yi is the dependent variables standing for consumer's demand for local Rice, $X_1$ is a vector for factors affecting consumer's preference for local Rice and $\varepsilon_i$ is the disturbance term, standing for deviation of binary from mean. The model is presented as

$$\text{Log } (p_i/1\text{-}p_i) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5x_5 + \varepsilon_i \quad (10)$$

Where $P_i$ stands for probability of the respondent preference for local Rice and $(p_i/1\text{-}p_i)$ is the odd ratio in favour of respondents' preference for local Rice and $x_1 \ldots\ldots x_n$ represent the socio economic characteristics $\varepsilon_{is}$ the error term, while $\beta$ are the logistic coefficients for the independent variables

Critique of Logistic Model

The result of the model can change depending on how you categorise your dependent variables, this lead to loss of information that mislead and cause confusion. The residual cannot be normally distributed (OLS Assumption). The OLS makes nonsensical prediction, since the dependent variables is not continuous. It is limited to prediction of quantitative output

v.**Translog Model**. It is the most flexible amongst the demand preference models. It is among the pioneer model developed by Christensen *et al.* (1975) to estimate the demand preference.

Critique of the model

It produces unrestricted estimate of the substitute elasticity, due to difficulty of non-linear estimation (Urga and walter, 2003).

### 2.13 Linearized Approximated Almost Ideal Demand System (LA/AIDS)

Koc and Alpay (2002) used LA/ AIDS model in household demand study in Turkey. The researchers used data on the cost of bundles of goods aggregate and services as approximation for price. AIDS model was also employed to show spatial variation in price of aggregated goods and services as described by Muellebuaer and Deaton, (1980). Adepoju, (2007) Mottaleb and Mishra, (2016), used AIDS model on industrial demand for maize in three states in Nigeria. Time series data were employed with the assumption that demand for industry was a derived demand. Breweries, livestock feed, food and confectionary industries were the study's target. The price did not influence the demand for maize; only factors like population and per capita income influenced the demand for maize. The price elasticity of livestock feed and breweries were 0.493 and 14.894, respectively. Food and confectionary gave negative value of -0.457. The study revealed that maize should be substituted with close substitutes like sorghum. Finally, it

was noted that there was strong preference for maize by the industry, given expenditure elasticity of greater than one (7.265). This means additional allocation has to be given to maize. Taljaard *et a*l. (2004) use LA/AIDS to study demand relation for meat (Beef, chicken, pork and mutton) in South Africa from 1970 to 2000 to test for the weak separability, including an F and likelihood ratio, fail to reject the null hypothesis of weak separability, confirming that the four meat products are separable and compensated unpriced elasticities of all four meat product are relatively inelastic. The uncompensated price elasticity also carry a priori expected negative signs and are statistically significant at 5% level, the expenditure elasticity for the beef and mutton are greater than one indicating that they can be consider luxury good. Although the expenditure elasticity of pork is less than one falling between luxury and necessary products The relative low of elasticity of chicken indicated that chicken can be considered a necessity as a protein source in South Africa diet.

### 2.13.1 Framework for LA/AIDS model estimation

The AIDS model is based on consumers' expenses. It shows the budget share of a given commodity as a function of total expenditure and price. The model allows budgeting in stages as suggested by Deaton and Muelbauer, (1980).The consumer decides how much to spend on rice and the next goods. The price of individual rice determines the demand for specific rice category. The research work will adapt the model used by Bamba *et al*. (2010) to estimate the expenditure elasticity that is the Hicksian price elasticity.

### 2.13.2 Hicksian price elasticity

This will be used in estimating the adjustment that consumer will make in the consumption of rice with one characteristic as a reaction to change in price of another

rice. The model was adapted from the study of Bamba *et al*. (2010) and stated as follows;

$$e^{h}_{ij} = e^{m}_{ij} + w_j e_i \quad (11)$$

Where;

$e^{h}_{ij}$ = Hicksion price elasticity,

$e^{m}_{ij}$ = Marshallian price elasticity,

$w_j$ = Budget share of rice item I and

$e_i$ = Expenditure elasticity

### 2.13.3 Expenditure elasticity

This measures the responsiveness of consumers' expenditure on different rice quality due to change in consumer's income. It is specified as;

$$e_i = 1 + \beta_i \ w_i \quad (12)$$

Where;

$e_i$ = Expenditure elasticity of rice item i,

$\beta_i$ = Expenditure co-efficient of rice item i, and

$w_i$ = Budget share of rice item i

### 2.13.4 Own price elasticity

This measure the response of the consumer's quantity of rice bought as a result of price of different characteristics in question, holding utility fixed while minimizing expenditure. It is specified as;

$$e_{ii} = 1 + (\gamma_{ii} \ w_i) - \beta_i \quad (13)$$

Where;

$e_{ii}$ = Own price elasticity of rice item i,

$\gamma_{ii}$ = Rice own price co-efficient,

$w_i$ = Budget share of rice item i, and

$\beta_i$ = Expenditure co-efficient of rice item i

### 2.13.5 Uncompensated price elasticity

This measure the response of the consumer's quantity of rice bought as a result of price of different characteristics in question holding price fixed while maximizing utility. It is specified as;

$$e^{m}_{ij} = \gamma_{ii} \; w_i + \beta_i \, w_j \;\; w_i \;\; \delta ij \qquad (14)$$

Where;

$e_{mij}$ = Mashallian price elasticity,

$\gamma_{ii}$ = Rice price co efficient,

$w_i$ = Budget share of rice item i,

$w_j$ = Budget share of rice item j,

$\beta_i$ = Expenditure co – efficient of rice item I, and

$\delta ij = 1$, when i = j, otherwise $\delta ij = 0$

### 2.13.6 Hedonic price past studies

Hedonic pricing model has been accepted and used on a wide range of issues. Many economists have applied the model as a tool for analysing price quality relationship of goods over time. The model hypothesizes that goods are measured based on utility. Rister *et al*. (1984) used Hedonic model to estimate market acceptance of rough Rice. The study observed that several factors were included in the differentiation of rough Rice. Hedonic price when used in Niger State revealed 83-95% price variability in the

sampled markets. The study further revealed a premium of 0.96 by consumer for each additional unit of grain weight of cowpea (Ibrahim, 2014).

The Hedonic pricing model was used to measure fresh tomato prices among markets by Hang and Lin (2007).The study objective was to assess consumers' valuation of' characteristics of fresh tomatoes and organic production. The model assisted in revealing the differences on price, by examining consumer preference for product characteristics. Additional prices were measured for quality of product, market and socio-economic characteristics that influenced retail price of the commodity. The result shows that sign and magnitude of additional prices in the study were reasonable. The result observed that the consumers were willing to pay higher price for organic tomatoes.

Hedonic pricing model when used in India revealed major differences in silk price (Naik, 1995). The study shows that quality characteristics established poor linkage between quality and price. Warburg and Foster (1994) worked on data of boar taint performance from a university Boar Test Station and auctioned sale data. The study estimated the data using Hedonic price model for back fat, loin eye area, average daily profit and feed efficiency of boar in the US. The result showed that variables used had significant impact on the auctioned price of boar.

### 2.13.7 Kendall's co-efficient of concordance

The Kendall's coefficient of concordance has been a scale for ranking consumers that are examining particular set of objectives (problems)(Legendre, 2005). The index that estimates the ratio of observed variance of the total ranks to the maximum possible variance of the ranks. The logic of the index is to get the total of the rank for each

problem that is ranked. The study of Ehiakpor *et al.(*2017) revealed that the quality factors such as the absence of foreign materials, packaging and aroma were also significant determinates of preference for local Rice. The top three trends consumer consider in their choice for local Rice were good looking grains, excellent packaging and absence of foreign materials in the local Rice. Also the work of Anyanwu *et al*. (2017) show that the result of the ranking revealed that non-attractiveness of Abakaliki local Rice was ranked as most influential constraints: inhibiting consumer's preference for Abakaliki local Rice with the mean rank of 1.63. The Kendell's coefficient of concordance obtained in the analysis was 0.38 and was significant at 1% level: suggesting that 38 of respondents agreed with the outcome of the ranking.

# CHAPTER THREE

## 3.0 METHODOLOGY

### 3.1 The Study Area

The study will cover Niger and Benue States in North Central zone of Nigeria. Niger State was carved out from North Western State of Nigeria on 3rd February, 1976 with headquarters at Minna. Niger State is located in the Southern Guinea Savannah ecological region of Nigeria, within Latitudes$6^0$ 30′ and$11^0$20′N and Longitudes $2^0$30′and$I0^0$30′E.It is bordered by Kaduna State and Federal Capital Territory (FCT), Abuja to the north-east and south-east, respectively. Kebbi State borders the State to the north-east and Kwara State to the South-West. The State shares boundary with Benin Republic along Agwara and Borgu Local Government Areas. The 25 Local Government Areas of the State are grouped into three agricultural zones, namely 1, 2 and 3. Zone 1 comprises Agaie, Bida, Edati, Gbako, Lavun, Mokwa, Lapai and Katcha Local Government Areas; Zone2 consists of Bosso, Chanchaga, Gurara, Munya, Paikoro, Rafi, Shiroro, Suleja and Tafa Local Government Areas while Agwara, Borgu, Kontagora, Mashegu, Magama, Mariga, Rijau and Wushishi Local Governments Areas are under Zone 3.

Niger State has two climatic seasons namely, the rainy and dry seasons. The distribution of rain is fairly even, falling within May and October. The range of rainfall is between 1,100mm and 1,600mm.Rainfall gets to its peak between August and September. The rainy days ranges from 155 to 215 days in a year. Relative humidity ranges from14% to40% in November– March, which is dry season and as high as 66% - 88% in April-September in raining season. The maximum temperature ranges from $36^0$-$37^0$Cwhich is observed between March and June, while the lowest temperature is observed from

December to January (Niger State Agricultural Mechanization Development Authority, 2013).The State has a total population of 5,087,920.7 as at 2015, estimated using 3.2 annual growth rate projection.

Niger State has a land area of 86,000Km$^2$ with 55% of this area fertile for crop production. Niger State Government Diary (2003) reported that the presence of large water bodies (Rivers Chanchaga, Gbakogi, Gurara, Kaduna and Niger and their tributaries) provide great avenue for the cultivation of different crops, local Rice inclusive. Niger State has 682,331 hectares of land suitable for local Rice production, however, less than 106,000 hectares is presently under cultivation. (National Population Commission, 2006 ).

Eighty five percent of non-literate people in Niger State are farmers (Niger State Agricultural Mechanization Development Authority, 2013). Small farm holders are predominant and they live mostly in rural areas where shifting cultivation is practised. The common crops cultivated are local Rice, maize, sorghum, millet, cassava, yarn, sweet potato, cocoyam, groundnut, cowpea, sugarcane and vegetables like okra, spinach and lettuce. The tree crops grown include mango, citrus, oil palm, coconut, cashew and banana. The livestock reared include cattle, sheep, goat and poultry.

Benue State derives its name from River Benue, the second largest river in Nigeria. The state, created in 1976, is located in the middle belt of Nigeria. It is an area within the quadrilateral formed by Latitudes $6^0 25'$ and $8^0\ 8'$ N of the equator and Longitudes $7^0 47'$ and $10^0 0'$E of the Greenwich meridian (NPC, 2006). The state shares boundaries with five other states; namely Nassarawa to the north, Taraba to the east, Cross river to the

south east, Enugu to the south west, Kogi to the west. The south eastern part of the state also shares boundary with the Republic of Cameroon. The State is also bordered on the north by 280km of River Benue, and is traversed by 202km of River Katsina-Ala in the inland areas. Benue State has a tropical climate, which manifests two seasons. The rainy season is from April to October, while the dry season is from November to March. Annual average rainfall varies from 1,750mmon the southern part of the State to 1,250mm in the North. In the mountain regions of Turan and Ikyurav-ya areas of Kwande LGA, average rainfall rises up to 4,000mm.The hot season comes in mid-April with temperature between $32^0$c and $38^0$c with high humidity (Benue Agricultural and Rural Development Authority, 2004).

The state has total area of about 30,955km$^2$ and is divided into 23 LGAs. These are Ado, Agatu, Apa, Buruku, Gboko, Guma, Gwer West. Others include Katsina-Ala, Koshisha, Kwande, Logo, Makurdi, Obi, Ogbadibo, Oju, Okpokwu, Oturkpo. Finally Tarka, Ukum, Ushongo and Vandeikya with headquarter at Makurdi. Benue State has total population of about 4.2 million (NPC,2006), adding up to 5,409,600 by 2015 using 3.2 growth rate projections. There are two main ethnic groups in Benue State, namely; Tiv, who represents about 72 percent of the total population and the Idoma who constitute 21 percent of the population. The Igede tribe represents 6 percent of the population; while smaller communities of Hausa, Fulani, Jukun Abakwa, Nyifon, Etulu, Igala and Igbo traders accounted for the remaining 1 percent of the population. About 75 percent of the population lives in the rural areas, with farming, being the main occupation. The state stretches across the transition belt between the forest and savannah vegetation. Much of the areas consist of undulating hills or grassy open space on the North and dry savannah on the South.

Benue is referred to the ‘‘Food Basket of the Nation’’, because of the abundance of its agricultural resources. About 80 percent of the state’s population is estimated to be involved in subsistence agriculture. The state is a major producer of food and cash crops like yam, cassava, local Rice, groundnut and maize. Others crops produced include sweet potatoes, millet, sorghum, sesame and wide range of others like soya beans, sugar cane, oil palm, mango, citrus and banana. Irrigation farming along the banks of Rivers Benue and Katsina-Ala is a common feature. It is also a common practice to find each farming family keeping one form of livestock or the other. These include poultry, rabbitry, piggery, sheep and goat on small scale. Lots of fishing activities are carried out on Rivers Benue and Katsina-Ala and irrigation is widely practiced along riverine areas during the dry season. Vegetable crops such as tomatoes, okra, carrots, onion, pepper and *amarantus* are also grown in large quantities. The strategic location of Benue State between the southern and forest region and Northern semi and grass land regions of the country endowed with fertile lands for agriculture, with the estimated arable land constituting about 60 percent of the total area. Average farm size is 1.5-2.0 hectares (BNARDA, 2004).

### 3.2 Sampling Procedure

Multi-stage sampling techniques were used; two states out of the six states in North Central Nigeria (Niger and Benue States) were purposively selected due to local Rice intensity of production and stratified into agricultural zones 1, 2 and 3. Two local Government Areas were selected from each zone and enumeration areas were randomly selected from each local government area. Sampling frame of households was generated using 2006 census enumeration list. Taro Yamane’s 1967) formula was used to generate the sampled size at 9% and 8% precision respectively for Niger and Benue States from

each Agricultural zone. Two hundred and eighty one (281) household heads Rice consumers were interviewed from the study areas as detailed in tables below.

Using Yamane, (1967) formula $n = \frac{N}{1+N(e)^2}$ (15)

Where

n = sample size

N = total population of respondent

e = level of precision in %

1 = unity

**Table 3.1 Sample distribution of respondents by zones in Niger State**

| Zones | LGAs | EAs | Sampling Frame | Sample size |
|---|---|---|---|---|
| 1 | Mokwa | Kudu | 20,671 | 16 |
| | | Rabba | 21,267 | 16 |
| | Katcha | Badeggi | 12,434 | 10 |
| | | Gbakogi | 11,452 | 9 |
| 2 | Paikoro | Kwakuti | 13,272 | 10 |
| | | TunganMallam | 14,065 | 11 |
| | Shiroro | Gwada | 12,693 | 10 |
| | | Kato | 8,026 | 6 |
| | | Erena | 5,010 | 5 |
| 3 | Wushishi | Zungeru | 7,433 | 6 |
| | | Maito | 4,243 | 3 |
| | Mariga | Beri | 17,130 | 13 |
| | | Bangi | 18,001 | 14 |
| Total | | | 165,697 | 125 |

Source; 2006 National population census Figures

**Table 3.2 Sampling distribution of respondents by zones in Benue State**

| Zones | LGAs | EAs | Sampling Frame | Sample size |
|---|---|---|---|---|
| 1 | Logo | Ayyin | 14,920 | 9 |
| | | Ugba | 16,510 | 10 |
| | Kwande | Adikpo | 16,507 | 10 |
| | | Ada | 14,491 | 9 |
| | | Ushah | 15,009 | 9 |
| 2 | Gboko | Gboko | 20,254 | 13 |
| | | Vende | 21,210 | 13 |
| | | Masaje ipav | 11,950 | 8 |
| | Makurdi | Gyado | 26,107 | 17 |
| | | Nbalah | 27,230 | 17 |
| 3 | Agatu | Igba | 11,501 | 7 |
| | | Obagaji | 10,850 | 9 |
| | Oturkpo | Adikwe | 20,420 | 13 |
| | | Okpomoju | 19,143 | 12 |
| Total | | | 246,172 | 156 |

Source; 2006 National population census figure

### 3.3 Data Collection

Two sets of data were collected from household heads, primary data was collected using structured questionnaire for 281 household heads that consume local Rice in their house s. Information regarding socio- economic characteristic type of local Rice preferred, quantity and qualities of local Rice needed by consumers. Others included disposable incomes earned per month and annual income and some of the factors inhibiting the purchase of local Rice in the study areas. Secondary data on output of local Rice, price in ₦/kg, area cultivated in hectare, fertilizer used 50kg/ bag and rainfall in millimetre were collected for determination of supply response of local Rice to price and non-price factors. The data was within 1980- 2016 for Niger and Benue States. These were

collected from Annual Review Publication of Niger State Agricultural Mechanization Development Authority (NAMDA, 2013), Annual report of Benue Agricultural and Rural Development Authority (BNARDA, 2004), Niger State Bureau of Statistics (NSBS) and Food and Agriculture Organisation (FAO) publications. The information collected includes producer price series of local Rice in ₦/kg, output of local Rice in tonnes and total quantity of fertilizer used in ₦/kg. Others include total hectare cultivated of local Rice, amount of rainfall in mm.

### 3.4. Analytical Tools

Objectives i and ii: were analysed using simple statistics and semi-log trend equation utilized in estimating compound growth rate (CGR) where a given year output depends on that of previous year. The use of CGR in studying the agricultural product has been used by Ammani (2015) using the well-known compound interest formula to the constraint of maize production/ hectare/yield.

$$Yt = Y0\ (1+ r)t \qquad (16)$$

Where

Yt = Quantity of local Rice produced/hectare/yield in year t

Y0 = Quantity of local Rice produced/hectare/yield in the base year

r = compound rate of growth of Y

t = time in chronological years

Taking the natural log of equation (16 to make linear, thus

$$\ln Yt = \ln Y0 + t \ln(1+r) \qquad (17)$$

Substituting lnY0 with β1 and ln(1+r) with β2, eqn. (17) is written as

$$\ln Yt = \beta 1 + \beta 2t \qquad (18)$$

Adding the disturbance term to equation (18) we obtain

$\ln Yt = \beta 1 + \beta 2t + \mu t$ (19)

Equation (19) is growth rate model derived for the estimation in this research. A semi log growth rate model is derived for this research since the interest is for absolute and relative change. The parameter of important interest in equation (19) is coefficient of β2(b2), the slope coefficient which estimates the constant proportional or relative change in Y for a given absolute change in the value of regress or t. first, multiplying b2 by 100 give the instantaneous growth rate at a point in time.

$IGR = b^2 \times 100$ (20)

Where

IGR = instantaneous growth rate

$b^2$ = is the least-square estimate of the slope coefficient $\beta^2$

Second, taking the antilog of β2and subtracting 1 from it and then multiplying the difference by 100 gave the compound growth rate CGR over a period of time

CGR can also be estimated using Euler's constant (2.718283)

$CGR = (e^{\beta 2} - 1) \times 100$ (21)

OR

$CGR = (\text{antilog } b^2 - 1) \times 100$ (22)

Finally, if the result of Euler's constant or $b^2$ is positive and statistically significant there is acceleration in growth, if they are negative and statistically significant there is deceleration in growth, if they are not statistically significant there is stagnation in the growth process. The growth model equations (21) and (22) were estimated using stata 11.0.

Objective iii was achieved using co- integration, Ordinary Lead Square (OLS) and vector Autoregressive model (VAR).

### 3.4.1Unit root test

As an important stage in co-integration, the data collected has to be checked for stationarity of each series and to be sure of order of integration of each series. Hair *et al.*(2010) pointed out that for co-integration to prevent spurious result, all the series considered should have the same order of integration, mostly *I*(1). The study used Augmented Dickey Fuller (ADF) by Dickey and Fuller, (1979) adopted from the work of Ogazi (2009), Ibrahim (2014) and specified in equation 23 as detailed below

$$\Delta Y_{t=} \alpha + \beta_i T + \delta_1 \Delta Y_{t-1} + \sum_{t-1}^{k} b_i \Delta Y_{t1} + \varepsilon_i \qquad (23)$$

Where;

$B_i$, $\delta$, $b_i$ = co-efficient

T= time trend

$\Delta$ = Change;

$Y_t$ = Variables (under investigation for stationary).

$Y_{t-1}$ = Past value of variables;

$\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$,

t= time variables; and

$\varepsilon_i$ = error term

Existence of unit root in $Y_t$ agrees with null hypothesis $\delta = 0$ that is non stationary series**.** When the value of ADF statistic is less than critical values it means $Y_t$ is stationary **(*Y*~*I(0)***a Type equation here. nd otherwise if is greater than and null will be rejected. Differencing at first means the series is not stationary at level and may be stationary at first difference *I*(1).If it is not, it may be differenced several times depending on the level of non stationarity.

### 3.4.2 Co integration

Co-integration permits the measurement of all the co-integrating relationships and provides bases for statistical test to test hypotheses about the number of co-integrating vectors and their functions in the system. Measurement of number of co-integrating vectors is vital as, under or over measurement has major problems for measurement and inference (Johansen *et al.,*2013).

### 3.4.3 Ordinary lead square (OLS)

The Ordinary Lead Square (OLS) is the type of linear least square method for estimating the unknown parameters in a linear regression model Hatemi. (2004). OLS chooses the parameters of a linear function of a set of explanatory variables by the principle of least square: minimizing the sum of square of differences between the observed dependent variable(value of variable being predicted) in a given data set and those predicted by the linear function. This is seen as sum of the square distance, parallel to the axis of the dependent variable, between each data point in the set and the corresponding point on the regression surface- the smaller the differences, the better the model fits the data. The resulting estimation can be expressed by a simple formula especially in the case of a simple linear regression on the right side of the regression equation.

The OLS estimator is consistent when the regressor are exogenous, and optimal in the class of linear unbiased estimator when the error are homoscedastic and serially uncorrelated (Hatemi.2004). Under this condition, the method of OLS provides minimum- variance mean-unbiased estimation when the errors have finite variances.

Under the additional assumptions that the errors are normally distributed, OLS is the minimum likelihood estimator. Suppose that the data consist of n observation

$(Y\mu Xi)i^n$ -1 (24)

Each observation I includes a scalar response $y_i$ and a column vector $X_i$ of value of p predictors (regresssors).

$X_{ij}$for j = 1, ----p. (25)

In a linear regression model, the response variable, $y_i$, is a linear function of the regressors:

$yi = \beta 1 x_i 1 + \beta 2 x_i 2 + ---+ \beta p\ x_i p + \varepsilon_i$ (26)

where β is a Px1 vector of unknown parameter; the εs are unobserved scalar random variable (errors which account for the influences upon the responses $y_i$ from sources other than the explanators $X_j$, and $x_i$ is a column vector of the $i^{th}$ observations of all the explanatory variables.

### 3.4.4 Model specification

The model for this study is specified as

$Yt = f(x_1+x_2+x_3+x_4+x_5) + u$

Where;

Yt =output = Rice supply

$X_1$ = price of Rice (₦)

$X_2$ = amount of rainfall (mm)

$X_3$ = quality of fertilizer used (tons)

$X_4$ = yield of Rice (tons)

$X_5$ = area cultivated (ha)

U = error correction model

### 3.3.5 Vector autoregressive model (VAR)

Vector Autoregressive Model (VAR) is a stochastic process model use to capture the linear interdependences among multiple term series. VAR model generalize the univariate autoregressive model (VAR model) by allowing for than one evolving variables. All variables in VAR enter the model in the same way: each variable has an equation explaining its evolution based on its lagged values, the lagged value of other model variable and an error term (Hetami.2004).

A VAR Model describes the evolution of a set of K variable called Endogenous variables over the same sample period.(t = 1---T) as a linear function of only their past value. The variables are collected in K-vector (K x1)- matrix $Y_t$ which has the $i^{th}$ element. $Y_{it}$ the observation at time t of the $i^{th}$ variable for example if the $i^{th}$ variable production, then $Y_{it}$ is the value of production at time t

A$p^{th}$ order VAR, denoted VAR(p) is

$$Yt = C + A_1 Y_t - 1 + A_2 Y_t - 2 + --- + A_p y_t - p + \varepsilon_t \quad (27)$$

Where the observation yt-I (I periods back) is called the i lag of y, C is a K-vector of constants (intercepts), A is term – invariant (KxK) – matrix and $\varepsilon_t$ is a vector of error term satisfying

1 .$E(e_t) = 0$ – every error term has mean zero

2. $E(e_t\ e^1_t) = \Omega$- the contemporaneous covariance matrix of error terms is Ω(aK x k positive- semi definite matrix);

3. $E(e_t e^1_t - k) = 0$ for every non-zero k - there is no correlation across term; in particular, no serial correlation in individual error term (Hatemi.2004).

### 3.4.6 Order of integration of the variable

All the variables have to be of the same order of integration; all variables are 1(0) (stationary): this is in the standard case that is a VAR in the level. All the variables are 1(d) (non-stationary) with d > than 0. The variables are co- integrated first, the variable have to be difference d times and one has a VAR in difference.

Determine the responsiveness of local Rice supply to change in price and non-price factor following Ogazi. 2019 as

$$\Delta \ln Yt = \sum^{n}_{i=1} B_{1i}\, \Delta \ln PR_{t-1} + \sum^{n}_{i=1} \Delta_{1i}\, \Delta \ln PI_{t-1} + \sum^{n}_{i=1} \delta_{1i}\, \Delta \ln RFt_{-1} + \sum^{n}_{i=1} \delta_{1i}\, \Delta \ln FU_{t-1} + \sum^{n}_{i=1} \delta_{1i}\, \Delta \ln YR_{t-1} + \sum^{n}_{i=1} \delta_{1i}\, \Delta \ln AC_{t-1} + \alpha\, ECT_{t-1} + \varepsilon_i \quad (28)$$

All other variable will be incorporated as above

Where:

$\Delta \ln Yt$ = Output = local Rice supply in year t, proxies by local Rice output

$\ln PR_{t-1}$ = Logarithm price of local Rice in year t (₦/tons)

$\ln RFt_{-1}$= Logarithm Amount of rain fall in year t (mm) as climate element

$\ln FU_{t-1}$ = Logarithm quality of fertilizer used in year t (tons)

lnYRt-1= Logarithm of yield of rice (kg)

lnACt-1= Logarithm of area cultivated in year t (ha)

$ECT_{t-1}$= Error correction term

$\Delta$ = change

$\varepsilon_i$ = error for variables that are not capture

n = lagged observed terms

### 3.4.7 LA/Almost ideal demand System (LA/AIDS) model

The LA/AIDS was used to achieve objective 4. The model is specified as follows; following Deaton and Meulbaure 1980, Alston and Chalfant 1993 and Eales and

Unnevehr 1994, the theoretical specification of AIDS model is the $i_{th}$ equation in the AIDS model can be define as:

$$w_{it} = a_i + \sum_j^n \gamma_{ij} \ln P_{ji} + \beta_i \ln(X_t / P_t) + u_{it} i = 1, \ldots, n \quad (29)$$

and where, in observation:

- $W_{it}$ is the budget (expenditure) share of the $i^{th}$ good;
- $P_j$is the normal price of the $i^{th}$ good;
- $\ln X_t$ is total expenditure;
- $u_{it}$ is the random or error term ; and
- $\ln P_t$ is the translog price index defined by:

$$\ln P_t = a_0 + \sum a_j \ln P_j + \frac{1}{2} \sum_i^n \sum_j^n \gamma_{it} \ln P_{it} \ln P_{jt} \quad (30)$$

This price index makes the system non- linear, which normally complicate the estimation process. In other to overcome this problem, Deaton and Meulbauer (1980) suggest using another linear price index.

### 3.4.8 Linearizing the AIDS

As explained above, the only difference between the AIDS and its linear version, the LA/AIDS lies in the specification of the price index. Several authors, including Green and Alston (1991); Pashardes (1993): Alston *et al*. (1994): Ascher and Wessels (1997) have discussed the relationship between the linear and nonlinear specifications. In several of this study, Monte Carlo studies were used to show that the use of different functional forms of the index in the LA/AIDS provides results that compare reasonably well to the AIDS model (Ascher and Wessels. (1997).

The stone's price index, as suggested by Deaton and Meulbauer (1980), which can be used to replace the translog price index, is define as follows

$$Log P = \sum_{i=1}^n w_{i,t} \log P_{i,j} \quad (31)$$

Eales and Unnevehr (1988) show that the substitution of the stone's price index for the translog price index causes a simultaneity problem, because the dependent variable $w_{it}$also appear on the right-hand side of LA/AIDS. They suggested using the lagged share ($w_i$ t – 1) for equation 3 replacement of equation 3 with the lagged shares into equation 1 yields the LA/AIDS, given by

$$w_{it} = a_i + \sum_j^n \gamma_{ij} \ln P_{ji} + \beta_i \ln\left(LnX - \sum_{i=1}^n w_{i,t-1} \ln P_{i,t}\right) + u_{i,t} \quad (32)$$

Equation 4 can then be applied to the empirical data, where after the anticipated parameters can used to calculate the required elasticities. The formulas require for these calculations are provided in the next section.

### 3.4.9 Price and expenditure elasticities

Compensated and uncompensated elasticities were calculated by using the formulas reported by Jung(2000) as shown in equation 33 and 34 respectively:

$$e_{i,t} = e_{it} + w + \beta\left(\frac{w_j}{w_t}\right) = -\delta + \frac{\gamma_{it}}{w_t} + w_j \mathrm{I}, \mathrm{J} = 1,2, \ldots., \mathrm{N} \quad (33)$$

$$e_{i,t} = -\delta + \frac{\gamma_{it}}{w_t} - \beta\left(\frac{w_j}{w_t}\right) \quad (34)$$

Where = 1 for i =j and = 0 otherwise. The average expenditure share is represented by wi whereas βt and yit are RSUR parameter estimates for the LA/AIDS model.

The formula used to calculate the expenditure elasticities can be written as

$$n_i = 1 + \frac{\beta_i}{w_i} \quad (35)$$

### 3.4.10 Data entry for LA/ AIDS model

$P^S$ = Price of short local Rice(SGP) bought(₦/kg)

$P^L$ = Price of long local Rice(LGP) bought(₦/kg)

$Q^S$ = Quantity of short local Rice (SGP) bought (₦/kg)

$Q^L$ = Quantity of long local Rice(LGP) bought (₦/kg)

Total expenditure on short local Rice bought per household

Total expenditure of long local Rice bought per household

$X^S + X^L = X$= sum total expenditure of all categories of Rice bought per household

$W^i = P^S Q^S / X$ (36)

$W^i$ = Budget share of short grain local Rice

$P^S$ = Price of short grain local Rice bought

Qs = Quantity of short grain local Rice bought

X = Sum total expenditure of all categories of Rice

$W^j = P^L Q^L / X$ (37)

$W^j$ = Budget share of long grain local Rice in (₦/kg)

$P^L$ = Price of long grain local Rice bought in (₦/kg)

$Q^L$ = Quantity of long grain local Rice bought in (₦/kg)

X = Sum total expenditure of all categories of Rice

$LnP^S$ = Logarithm of price of short grain local Rice

$LnP^L$ = Logarithm of price of long grain local Rice

$P^S* = W^S (LnP^S)$ = Price index for short grain local Rice

$P^L* = W^L (LnP^L)$ Price index for long grain local Rice

Ln $(X/P^S*)$ = Logarithm of total expenditure deflated by price index of SGP

Ln $(X/P^L*)$ = Logarithm of total expenditure deflated by price index of LGP

### 3.5 Hedonic Price Model

The theory is based on the basic price of a marketed good as it relates to its attributes, qualities or its utility. The utility could be internal. The consumer is allowed to choose the quality that maximizes utility subject to budget constraint (Isaac and Irenne, 2014).

The model is specified as follows;

Max U(V) (38)

Subject to Z = Vx (39)

$Y \geq pq$ (40)

Where;

U= utility,

Z= budget constraint,

P= market price of the commodity,

Y= consumers' incomes, and

q = quantity of the commodity

The consumers are limited to selecting one integer unit of (x) from the various characteristics. The maximum attainable utility could be derived from consuming only one characteristic among the given choices. Griliches (1959) and Gujarati and Porter (2007) observed that for products with multiple characteristics, price differentiation comes to mind due to quality characteristics. Thus, he expressed $P_1$ as a function of a set of quality characteristics (x) and sum addition of small random factors measured by error term $\varepsilon_j$.

With this, the average contribution of local Rice characteristics for the price can be derived (Lowenberg-De Boer, 2010). Hedonic pricing has been accepted and used on a wide range of issues. Many economist have applied the model as a tool for analysing

price quality relationship of goods over time. The model hypothesize that goods are measure based on utility

### 3.5.1 Hedonic model specification

The implicit form of the model is specified as follows: following the work of Dalton, 2004 as quoted by Diako *et al*. (2010).

$$P_i = \alpha+\sum\beta_i X_i +\sum\Psi Y_i+\mathcal{E} \quad (41)$$

Where;

$P_i$ = Willingness to pay for rice characteristics (₦/kg),

$\alpha$ = Constant term,

$\beta_i$ = Estimated coefficient on rice characteristics,

$X_i$ = Rice characteristics,

$\psi$= 1-281 Coefficient of consumer socioeconomic characteristics,

$\mathcal{E}$ = Error term

The explicit form of the Hedonic model to achieve objective (v) is adopted from the work of Ibrahim, 2014 and Ocheni, 2016:

$$\ln P_i = \beta_0+\beta_1(MP)i+\beta_2(LG)i+\beta_3(WG)I\beta_4(AG)i+\beta_5(PM)i+\beta_6(TG)i+\beta_7(CT)i+\beta_8(ST)i+\beta_9(CO)+\beta_{10}(ED)i+\beta_{11}(GD)i+\beta_{12}(IN)i+\beta_{13}(HS)i+\mathcal{E}_i \quad (42)$$

Where;

$\ln P_1$ = Price of 100kg milled Rice (as a proxy for willingness to pay for Rice characteristics)(₦/kg)

Mp = Market price of milled Rice (₦/kg)

WG =Whiteness of Rice grain(1 if white, 0 otherwise).

AG = Aroma of Rice grain (3 point likert rating scale were used)

PM = Presence of foreign matter(1 if free from foreign matter,0 otherwise)

TG = Taste of Rice grain (3 point likert rating scale were used and the mean value of each respondent included in model)

CT = Cooking time of Rice grain (in minute, different categories of Rice bought from consumers were collected and taken to the laboratory, and the cooking time was recorded 20 – 25 minutes means short cooking time, while above 26 minutes were long cooking time.

ST = Stone free of Rice grain (1 if free from stone,0 otherwise)

CO = Cohesion after cooking (sticky 1, 0 if otherwise)

ED = Educational level (number of years spent in school)

IN = Income (Annual disposable income of consumer in ₦ from farming)

HS = Number of household of respondent

$\beta_O$ = Constant term

$\beta_1$ to $\beta_{13}$ = Regression parameters to be estimated

$E_1$ = Error term

I = $i^{th}$ Respondents

### 3.6 Kendall's Coefficient of Concordance

Kendall was used to achieve objective vi and model specified as equation 33 following the work of Isaac *et al*. (2014)

$$W = \frac{12S}{P^2(n^3-n)-P^T} \qquad (42)$$

Where;

W= Kendall's co efficient of concordance

S = Sum of square Statistics over the row sum of ranks ($R_I$)

P = Number of respondents ranking constraints

n = Number of constraints

T = Correction factor for tied ranks

The sum of square Statistics (s) is given as

$$S = \sum^{m_i}_{i-1}(R_i - R)^2 \quad (43)$$

Where;

$R_i$ is row sums of rank and R is the mean of $R_i$

The correction factor for tied ranks (T) is given as

$$T = \sum^{m}_{k-1}(t_3 - tk); \quad (44)$$

Where;

$t^3$ = number of ranks in each k of m group ties

The test of significance was done using the chi-square statistics which is computed using the formula

$$\chi^2 = P(n-1)w ; \quad (45)$$

Where;

$\chi^2$ = chi – square statistics

n = number of constraints

P = number of respondents

w = Kendall's co efficient of concordance

The decision rule is that if the calculated chi-square is greater than the chi-square critical then the null hypothesis is rejected

Stata 11.0

### 3.6.1Measurement of degree of agreement among inhibiting characteristics

To measure the degree of agreement or concordance among the characteristics on inhibiting factors, the inhibiting factors will be ranked from the most influential to the least, using figures l, 2, 3, 4, 5, and 6--n. The total ranked score for each factor will be computed and the factor with smallest score will be the most inhibiting factor. The total score will be used to calculate the co-efficient of concordance (w) which gives the final judge. The entrance of Kendall's coefficient of concordance is to achieve objective vi (factors inhibiting purchase of locally produced rice).

The model is specified as follow;

$$W = 12\sum T^2 — (\sum T)^2/[n/nm^2(n^2-1)] \quad (46)$$

Where;

W = Co-efficient of concordance,

T = Summation ranks for factors being ranked,

n = Number of factors to be ranked, and

m = Number of respondents

The (W) coefficient of concordance will be tested for significance in term of F distribution.

F- ratio is F=(m-1)*(w)/(1-w)

m = number of respondents

n = number of factors to be ranked When farmer's response is positive to prices adjustment, supply of rice will be increased.

# CHAPTER FOUR

## 4.0 RESULTS AND DISCUSSION

### 4.1 Socio economic Characteristics of the Local Rice Consumers in the Study Area

The socio economic characteristics of local Rice consumers vary. This affects the consumption pattern of local Rice. Some of the socioeconomic characteristics considered in the study were age, gender, household size, education level and annual income levels as presented in Table 4.1 The result in table 4.1 shows the age range of 41 - 50 years in Niger and Benue States with 44% and 49% respectively. This means that these household heads were married and many with children. The number of wives and children determined the quantity of local Rice needed for consumption. The household heads that fall between the age range of 41 -51 were 44, 49 and47% in Niger, Benue states and pooled respectively. This is an indication that majority of the youths are running away from production of crops especially local Rice. The implication is that less of local Rice will be produced and supply for the increased demand. It is also indicated that those within the active ages of life need daily energy requirement, energy given food like Rice. This corroborates the work of Emodi and Madukwe. (2015) who asserted that labouring Adults require milled rice to meet the daily carbohydrate and protein for sustain. The mean age of the households in Niger and Benue were 45 and 47 respectively. This work corroborates that of Oyinbo. (2014) and Salihu *et al.*(2017), that age increases with increase in diversification of livelihood strategies.

Gender of the household head has great impact on local Rice consumption pattern, as opined by Agboola. (2003) the result in table 4.1 shows that all the respondents (100%) were male. Males always lead in north and it could be the influence of the two common religions practiced in the northern part of Nigeria. These religions belief that only male should be the head of the family. The research work corroborates the findings of (Oyinbo. 2014). The research argued that males head the house, and determine the quantity of local Rice that should be consumed at a time depending on the size of the house.

Table 4.1: Socio economic characteristics of local Rice consumers

| **Variables** | **Niger** | | **Benue** | | **Pooled** | |
|---|---|---|---|---|---|---|
| | **Freq.** | **Percent.** | **Freq.** | **Percent.** | **Freq.** | **Percent.** |
| Age | | | | | | |
| 20 -30 | 4 | 3 | 2 | 1 | 6 | 2 |
| 31 – 40 | 34 | 27 | 32 | 21 | 66 | 24 |
| 41 – 50 | 54 | 44 | 78 | 49 | 132 | 47 |
| 51 – 60 | 33 | 26 | 8 | 5 | 76 | 27 |
| Total (mean) | 125(45) | 100 | 156(47) | 100 | 281(46) | 100 |
| Gender | | | | | | |
| Male | 125 | 100 | 156 | 100 | 281 | 100 |
| Total | 125 | 100 | 156 | 100 | 281 | 100 |
| Household size | | | | | | |
| 1 – 10 | 118 | 94.4 | 118 | 75 | 236 | 84 |
| 11 – 20 | 7 | 5.6 | 38 | 25 | 45 | 16. |
| Total (mean) | 125(6) | 100 | 156(8) | 100 | 281(7) | 100 |
| Educational. Level | | | | | | |
| Primary | 13 | 10.4 | 29 | 19 | 42 | 15 |
| Secondary | 35 | 28 | 53 | 34 | 88 | 31 |
| Tertiary | 41 | 32.8 | 73 | 47 | 114 | 41 |
| No formal | 36 | 28.8 | - | - | 36 | 13 |
| Total | 125 | 100 | 156 | 100 | 281 | 100 |
| Annual income (₦) | | | | | | |
| 201,000 -400,000 | 34 | 27.2 | 20 | 13 | 54 | 19.8 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 401,000 – 600,000 | 70 | 56 | 79 | 51 | 149 | 53 |
| 601,000 – 800.000 | 11 | 8.8 | 24 | 15 | 35 | 12 |
| 801,000 – 1000,000 | 10 | 8 | 33 | 21 | 43 | 15 |
| Total | 125 | 100 | 156 | 100 | 281 | 100 |

Source: Field survey, 2017

Household size determines the quantity of local Rice to be bought and consumed. The household size was relatively high among the respondents. Majority of the respondents have household size of 1-10 persons for Niger and Benue State respectively. These revealed 94.4% and 75% respectively for this range. The mean household sizes were 6 for Niger State 8 persons for Benue State and 7 persons for the pooled. The implication of this is that income that will be used for investment will be diverted for feeding the family. This family labour may be of great advantage for production as a substitute to paid labour. This also agrees with the study of Salihu *et al.* (2017) and Ehiakpor, (2017) that opined that consumption of any kind of food product and income expenditure increases with increase in household size mostly for normal goods.

It is assumed that a well-educated respondent can easily get access to information concerning nutritional value of all kinds of local Rice available in the market from the labels written on their package bags. This information could have positive or negative effects on the use of local Rice because quality local Rice that is clean may be favoured while low quality local Rice may be affected negatively. In Niger State 60.8 percent of respondents acquired both secondary and tertiary education, compared to Benue State with 81 percent respondents for secondary and tertiary. This means that majority of the respondents were educated in one way or the other. The implication of this is that in Niger and Benue States consumers like local Rice that is clean with higher qualities.

This agrees with the works of Ahmad *et al.* (2010), Ahmad *et al.* (2011) and Olurunfemi (2014) who argued that educated respondents can easily comprehend information because of their capability to read. There are processing and milling commercial centres where local Rice are milled and packaged with label this enable consumers to read labels on products to gide their consumption decision.

Income is a vital factor that influences household food consumption. As income of household increases the food consumption also increases (Salihu *et al.,* 2017). Although due to low quality of local Rice, as the income increases the respondents may change to foreign Rice. The result presented in table 4.1 shows that 83, 64 and 72% of the respondents in Niger Benue States and pooled were low income earners. This may reflects negatively on consumption of local Rice. The implication is that most of them consumed local Rice with low quality and quantity. This agrees with the studies of Salihu *et al.* (2017), Kassali *et al*. (2010) and Ahmad *et al*. (2011). Who argued that income may affect the consumption of local Rice, increase in income may equally increases quantity of local Rice demanded and maintain good health. This also affects the local Rice supply which on other way increase income and vice versa.

### 4.2 Niger State Local Rice Production Trend 1980 -2016

Table 4.2 below shows the pattern in local Rice production in Niger State from 1980-2016. The table revealed a total of 20,994,225.08 metric tonnes for the year 1980 -2016. The mean range of production was 567,411.49 metric tonnes. The skewness and kurtosis were positive indicating increase in production all through. This means that all the value range were within the mean production. There was an indication that land area expansion contributed to increase in production. The mean yield was 2.45 tonnes per hectare and the total yield was 90.74 million metric tonnes. The standard deviation

shows that the value lies within the mean; skewness and kurtosis were positive indicating increase in the yield. In a related development, price took a different dimension, with mean of ₦84,450.08. The standard deviation revealed dispersion of values from the mean. This indicated a serious fluctuation of local Rice price over the years under investigation. This may be due to seasonal variation like drought, floods and glut after harvesting. The policy implication should be provision of irrigation facilities, storage and acceptable marketing channels for farmers.

The fertilizer that was used has its mean of 3.748 with standard deviation of 2.708. This means the values were not scattered around the mean. The skewness and kurtosis were all positive indicating increase in fertilizer usage. The maximum fertilizer used was 13.85 million tonnes and minimum was 0.95 tonnes. The mean of rainfall was 1120.724mm, the maximum and minimum were 1673.6 and 585 mm respectively. The skewness and kurtosis were negative to the left, indicating reduction in amount of rainfall. The policy implications are provision of early maturing local Rice varieties and provision of irrigation facilities to augment rainfall for production in Niger State (CBN. 2014). It is possible that unstable growth rate of local Rice production in Niger State in some of the years could be as result of unfavourable conditions in the State rice producing areas and inadequate implementation of some of the intervention programmes. In 1984 there was draught and rainfall stopped by September, this led to low output.

Table 4.2: Descriptive Statistics of Local Rice Trend in Niger State 1980 - 2016

| | AREA | YIELD | PRODUCTION | P/TONE | FERTILIZER | RAINFALL |
|---|---|---|---|---|---|---|
| Mean | 196134.811 | 2.452432 | 567411.4886 | 84450.0811 | 3.748405 | 1120.724 |
| Standard Deviation | 180027.916 | 1.050971 | 622385.921 | 82384.0689 | 2.708462 | 296.1325 |
| Kurtosis | 7.36339823 | 0.981042 | 4.455811118 | 4.7687608 | 3.976882 | -0.659216 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Skewness | 2.3136449 | 0.576842 | 2.194864145 | 2.00111511 | 1.684035 | -0.371954 |
| Range | 944772.91 | 4.65 | 2674138.74 | 376431 | 12.9 | 1088.6 |
| Minimum | 209.79 | 0.66 | 53279.04 | 17015 | 0.95 | 585 |
| Maximum | 944982.7 | 5.31 | 2727417.78 | 393446 | 13.85 | 1673.6 |
| Sum | 7256987.99 | 90.74 | 20994225.08 | 3124653 | 138.691 | 41466.8 |

Source: Niger state Agricultural mechanization Development Authority (1980 – 2016) Researcher's computation

The figeres below show the graphical trend of production, yield,price,area,fertilizer andrainfall in Niger State

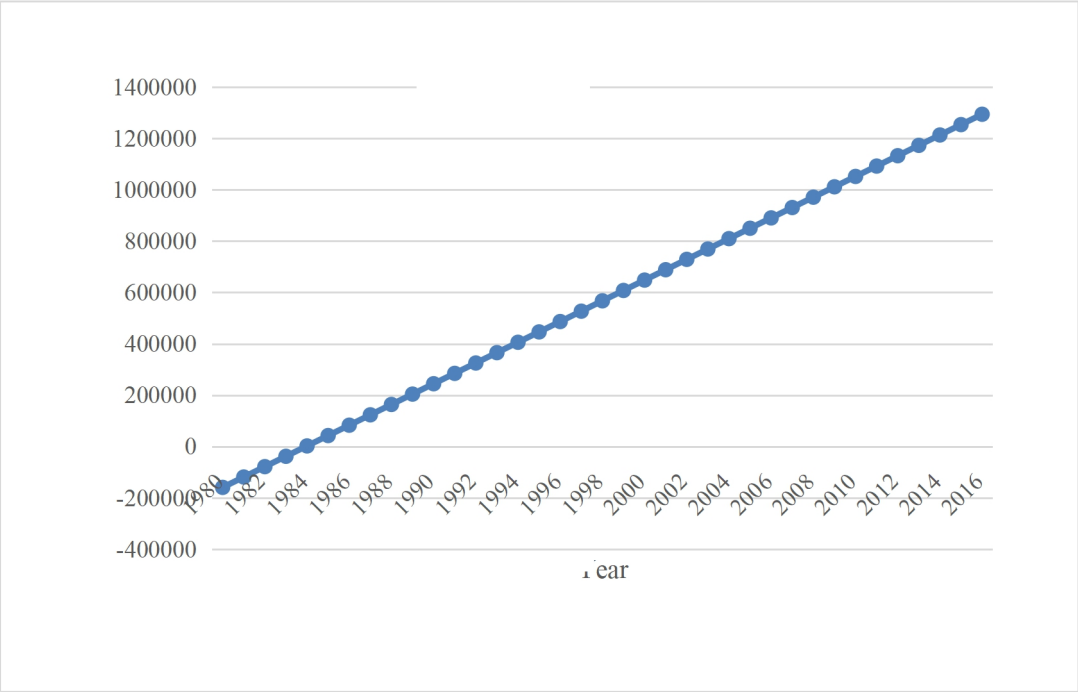



Figure 4.1 Production Trend

The 4.1 above show the production trend of local rice from 1980-2016 in Niger State. The graph show increase production of local in Niger State from 1980 – 2016 in metric tons.

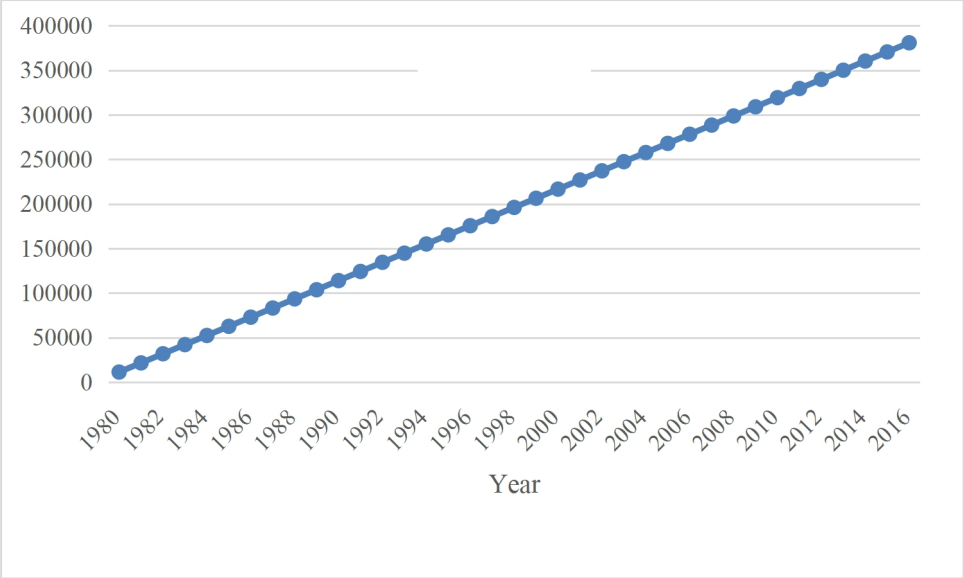



Figure 4.2 Area Trend

Figure 4.2 revealed that the area cultivated to Rice in hectares from 1980 -2016 Contributes to increase in production in Niger State. Area expansion magnitude may not be felt much without good management practices and proper production inputs like fertilizers and chemicals

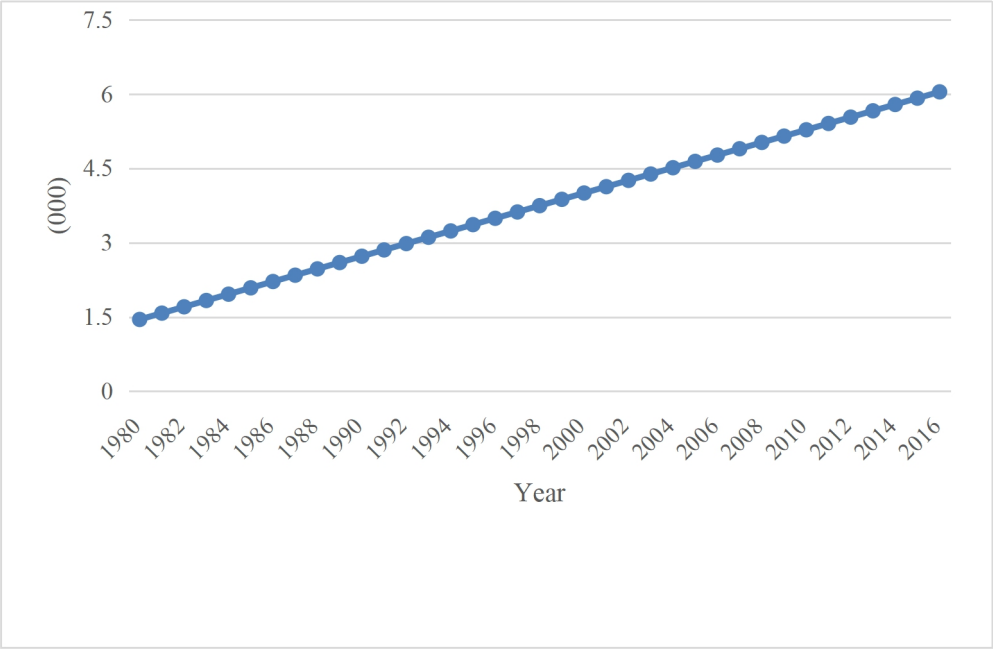



Figure 4.3 Fertilizer Trend

Figure 4.3 identified the total number of fertilizer used in million metric tons annually. The graph shows that even with increased cost of fertilizer use of fertilizer also increases from 1980 – 2016.

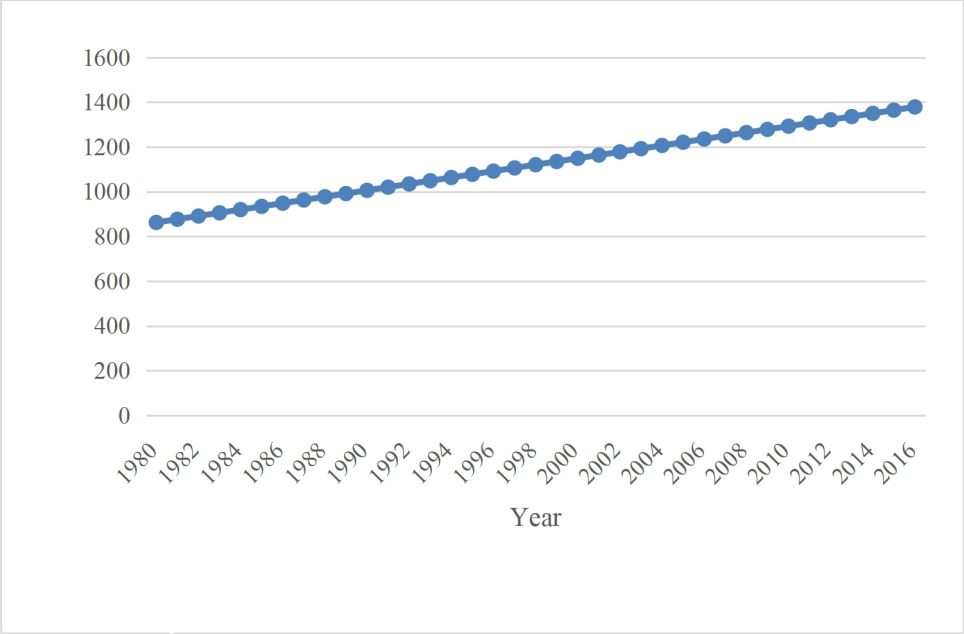



Figure 4.4 Rainfall Trend

Figure 4.4 shows the amount of rainfall recorded from 1980 – 2016 on annual bases. It is revealed that the rainfall range is between 900 mm to 1400mm in these years under investigation.

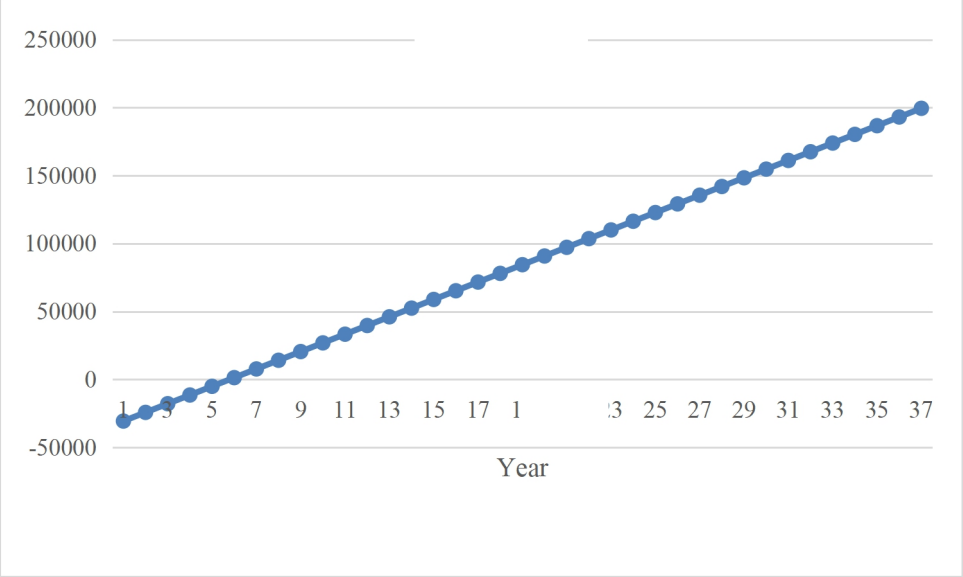



Figure 4.5 Price Trend

Figure 4.5 Increase in the trend of local Rice from 1980 – 2016. From the graph the appreciation of the price was not much encourage the local Rice producers.

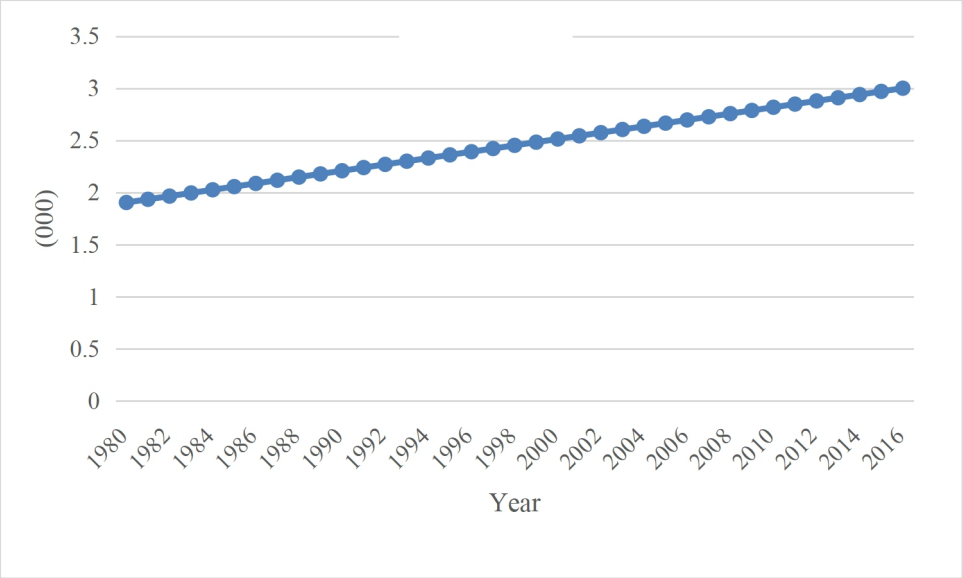



Figure 4.6 Yield Trend

Figure 4.6 Yield of local rice in million metric tons produced annually. This graph revealed very slow growth in the yield of local Rice from 1980 -2016.The production ranges from 2million to 3million metric tons annually in these years.

### 4.2.1 Local Rice production and price Niger State 1980 – 2016

This shows that time trend variables were very important factors in measuring the quantity of local Rice production and price in Niger State. The table further reveals that the coefficient of determination were ($R^2$ = 0.6618) and ($R^2$= 0.8212) for the local Rice production and price respectively. The table further shows that quantity of local Rice production and price in Niger State indicated a significant growth from 1980 – 2016 production periods. The result indicated that the coefficient of time variable was positive and statistically significant at 1% with respect to quantity of local Rice production and the price of local Rice within these years. And the significant probability value of (P< 0.00398) during the period of significant growth in production and price. This shows that growth solely depend on time. As it was observed by (Onu *et al.* 2015) that local Rice production in Nigeria depends on time.

Table 4.3: equation for production and price in Niger State 1980 -2016

| Dependent Variable | $B_0$ | $B_1$ | $R^2$ | Adj. | F-ratio |
|---|---|---|---|---|---|

| | | | | $R^2$ | |
|---|---|---|---|---|---|
| Qty of production | 1965.2*** | 0.000128 | 0.6618 | 0.6521 | 0.00398** |
| Price per tonne | 1985.8*** | 0.000149 | 0.8212 | 0.8161 | 0.00431** |

*** represent 1% significant level
Source: Computed by researcher

### 4.2.2 Production and price growth rate in Niger State (1980 -2016)

The computed growth rate of quantity of local Rice produced and price in Niger State are presented in Table 4.3. The estimated growth rate indicated slopes coefficient of 0.000128 and 0.000149 for local Rice production and price for a given change in quantity of local Rice produced and price multiply by hundred respectively. These gives percentage changes or rate of growth in quantity of local Rice produced and price for absolute change in time. The growth rates of 0.0128% and 0.0149% for local Rice production and price respectively indicated that over the period of 1980 - 2016 the production and price of local Rice in Niger State increased at point in time as shown in Table 4.3. Compound growth rate (r) of production and price were estimated from point in time growth rates (0.0128 and 0.0149). From the Table 4.4 below the coefficient of the trend variable, β2 indicated growth model with the value of0.0128. This means that over the period of 1980 – 2016, local Rice production in Niger State had an annual instantaneous growth rate of 0.0128% and the compound growth rate of 1.90%.. This can be inferred that there was little increase in local Rice production in Niger State

Table 4.4: Growth rate estimation for local Rice production and price in Niger State 1980 - 2016

| Parameter | local Rice $_1$ | Price |
|---|---|---|
| β2 | 0.000128 | 0.000149 |
| F(P –Value) | 5.768(0.00398) * | 4.916(0.00431)* |
| Instantaneous growth Rate (%) | 0.0128 | 0.0149 |
| Compound Growth Rate (%) | 1.90 | 3.09 |

* * represent 5% significant level

### 4.2.3 Benue State local rice production trend (1980 - 2016)

Table 4.6 depicted the pattern in local Rice production in Benue State from1980-2016. The maximum land area put to local Rice cultivation within these years was 4,607,633.3 hectares. This means that only small area was used from verse fertile land of 10 million hectares suitable for local Rice production. The implication is that more areas of land needed to be cultivated to avert Rice importation. The mean area cultivated was 124,530.6 hectares, skewness and kurtosis were both negative and normal indicating that areas cultivated continued to decrease. The standard deviation also revealed that values were not too far from the mean. The mean yield of 1.9 tonnes per hectare was recorded within the period under investigation, while the maximum yield was 2.87 tonnes. The skewness and kurtosis were both negative (-0.48 and - 0.67) indicating decrease in production and supply.

The maximum production for the year under investigation was 8,564,729.432 metric tonnes with the mean of 231,479.1738 metric tonnes. The skewness and kurtosis were negative and indicating decrease (-0618 and - 0.233). The mean price of local Rice from the period of 1980-2016 was ₦74,822.16 with skewness and kurtosis appearing positive (0.686 and 1.182). This shows increase in the price of local Rice, may be as a result of shortage. The maximum and minimum prices per tonne were ₦26,923 and ₦12,830 for the years under investigation. The mean price increase also increases local Rice production. The policy implication is that good marketing strategies be created for producers to enjoy better prices to ginger more supply of local Rice. The mean fertilizer used was 20.062 thousand metric tonnes with positive kurtosis and skewness of 36.0 and 6.0 respectively. This indicated increase in the use of fertilizer. The policy implication, government should provide fertilizer at cheaper rate or at reduced rate of money to enable farmers have access to it. Credit or loan can also be given to the farmers

.Table 4.5: Descriptive Statistics of Local Rice Trend in Benue State 1980 to 2016

| | AREA | YIELD | PRODUCTION | P/TONE | FERTILIZER | RAIN FALL |
|---|---|---|---|---|---|---|
| Mean | 124530.6297 | 1.8962973 | 231479.1738 | 74822.16216 | 24.0624324 | 2115.82162 |
| Standard Deviation | 29594.42399 | 0.51626511 | 65033.33416 | 65569.31674 | 124.206287 | 692.92565 |
| Kurtosis | -1.062523418 | -0.6704405 | -0.233756532 | 0.685771336 | 36.9649372 | -0.360246 |
| Skewness | -0.527658629 | -0.478031 | -0.618137921 | 1.182308822 | 6.07857695 | -0.3313571 |
| Range | 101240 | 1.86 | 272206.6 | 256408 | 757.89 | 2999.9 |
| Minimum | 68840 | 1.01 | 69528.4 | 12830 | 1.11 | 597.6 |
| Maximum | 170080 | 2.87 | 341735 | 269238 | 759 | 3597.5 |
| Sum | 4607633.3 | 70.163 | 8564729.432 | 2768420 | 890.31 | 78285.4 |

Source: Benue Agricultural and Rural Development Authority (2004)
Researcher's computation

The graphical trend of local rice variables in Benue State namely, area, production, yield, price, fertilizer and rainfall are shown below in figures 4.7-12

Figure 4.7 revealed the area of land put in to production of local Rice from 1980 – 2016.It is indicated that area cultivated for local Rice increase at a slow rate this may due lack of interest from the youth in the State to go into Agriculture.

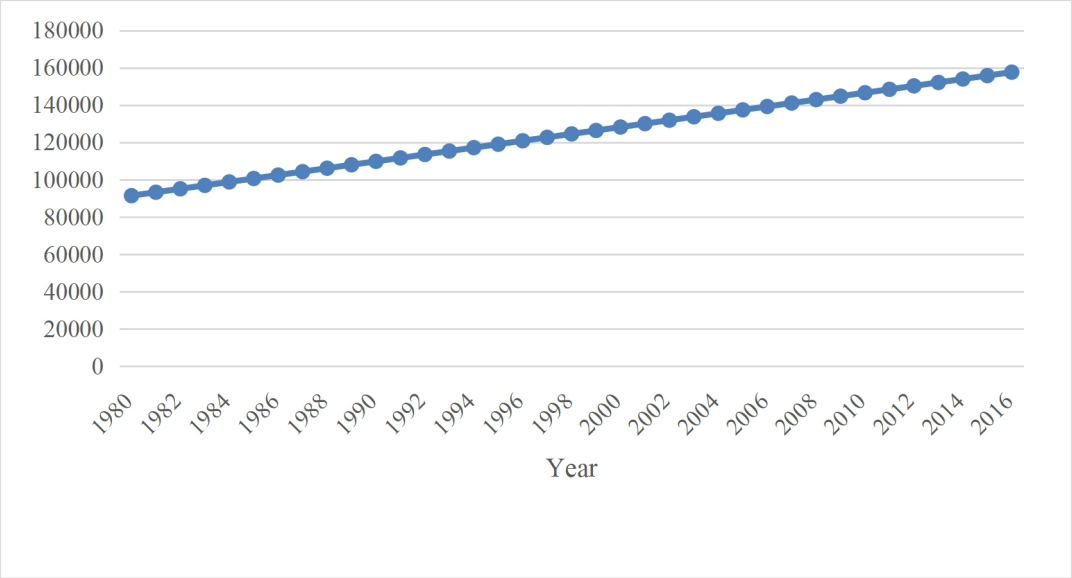



Figure 4.7 Area Trend

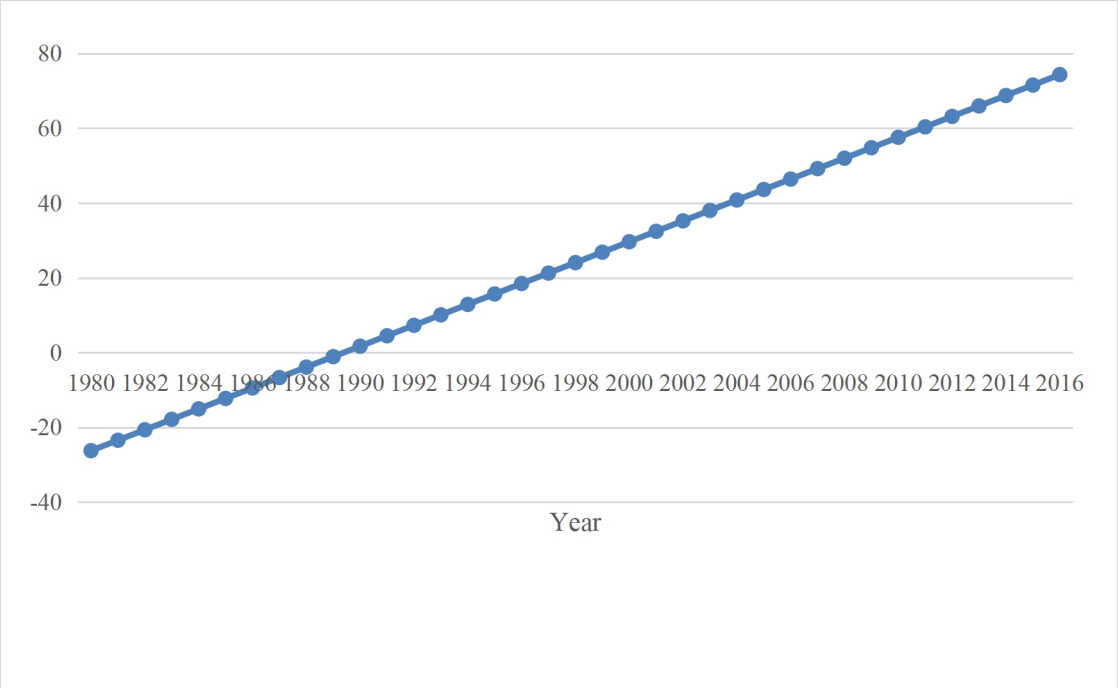



Figure 4.8 Fertilizer Trend

From figure 4.8 The trend of fertilizer usage for local Rice in Benue State from 1980 – 2016. It was indicated that there was increase in fertilizer usage as from 1989 to 2016 despite the cost.

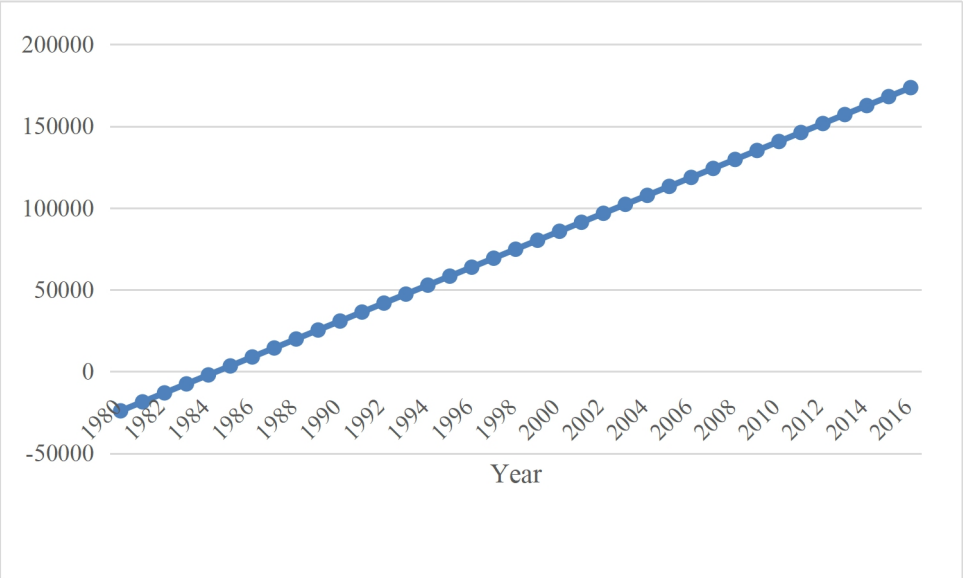



Figure 4.9 Price Trend

Figure 4.9 Increase of the price of local Rice from 1984. The trend revealed the price of local Rice per metric ton annually.

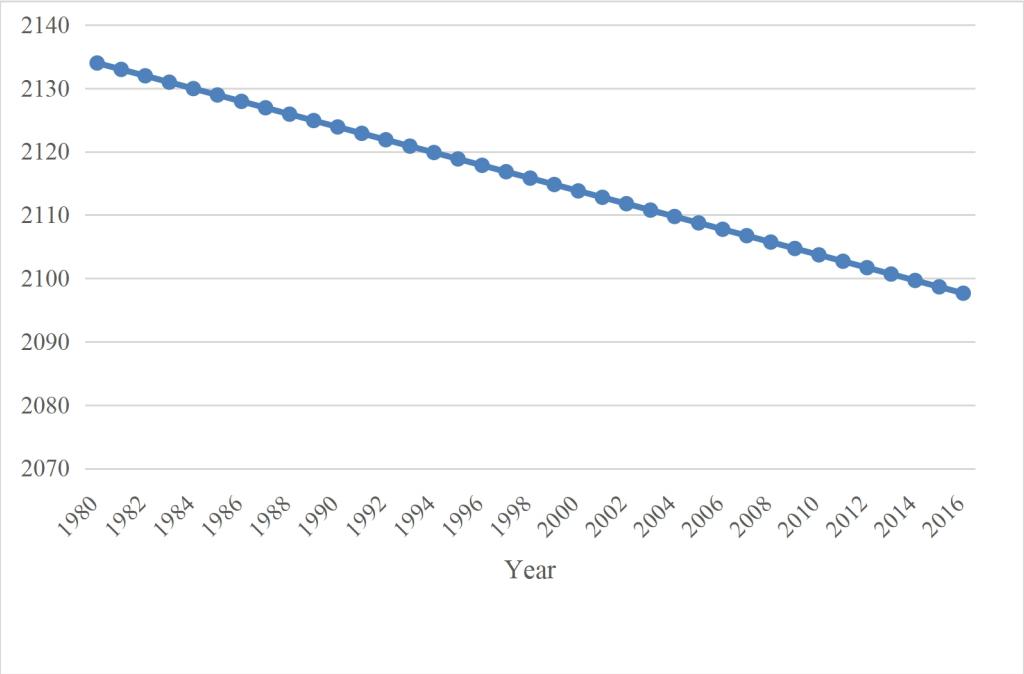



Figure 4.10 Rainfall Trend

Figure 4.10 Decrease in the amount of rainfall from 1980 – 2018. It was indicated that the amount of rainfall in the Benue State decreases gradually as indicated on graph.

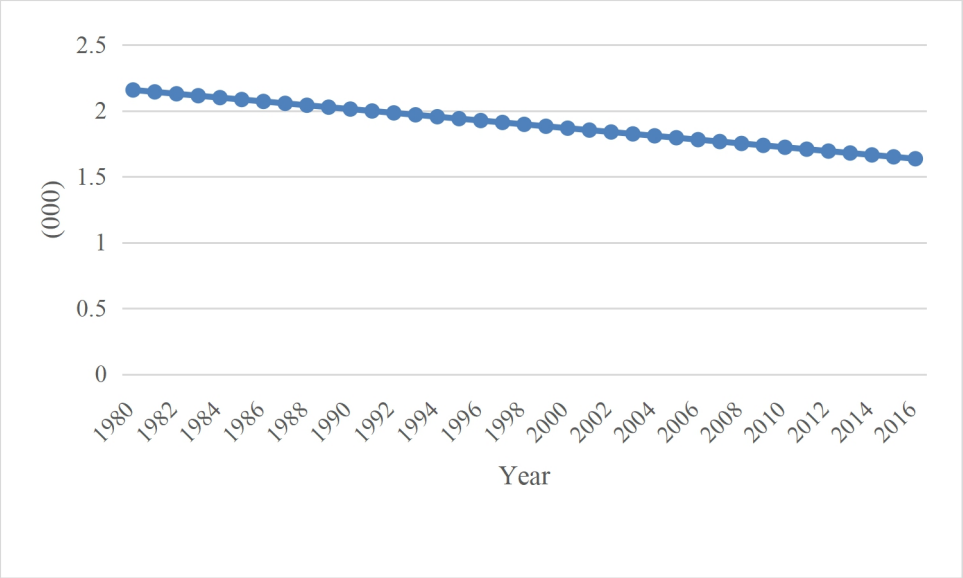



Figure 4.11 Yield Trend

From the grapy on Figure 4.11 it is clear that the yield of local Rice in Benue State dropped from 2.2 million metric tons to about 1.7 million metric tons from 1980 – 2016.

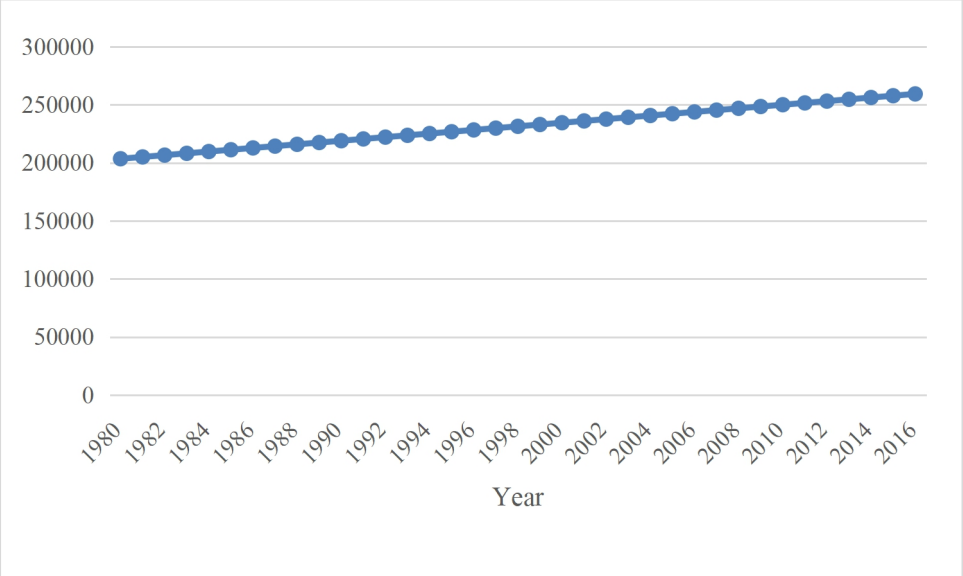



Figure 4.12 Production Trend

Figure 4.12 increase in local Rice production this may due to area expansion. It is indicated that production increased from 200,000 to 250,000 metric tons from 1980 and 2016.

### 4.2.4 Equation for quantity of local Rice production and price in Benue State (1980 – 2016)

Table 4.7 shows that quantity of local Rice production and price in Benue State had significant growth from 1980 – 2016. The result depicts that the coefficient of time variable was also positive and significant at 1% in respect of quantity produced and the price of Rice within these production seasons. This indicates that time variable were important factors in measuring the quantity of local Rice produced and price in Benue State. Table 4.7 also shows that the coefficient of determination were ($R^2 = 0.496$) for the local Rice production and ($R^2 = 0.705$) for the price and were all significant at 1% ($p < 0.000$) during the period. This also indicates that growth was time dependent.

**Table 4.6: Equation for Rice produced and price in Benue State (1980 -2016)**

| Dependent Variable | $B_0$ | $B_1$ | $R^2$ | Adj. $R^2$ | F-ratio |
|---|---|---|---|---|---|
| Qty of production | 1991.94 | 0.0000122 | 04962 | 0.4781 | 0.00431** |
| Price per tonne | 1986.806 | 0.0001103 | 0.7054 | 0.6970 | 0.00230*** |

*** represent 1% significant level
Source: computed by researcher

### 4.2.5 Rate of growth of production and price in Benue State (1980 – 2016)

The computed growth rate of local Rice produced and price in Benue State within these periods were presented in Table 4.7. The estimated growth rate in the table shows slope coefficients of 0.0000122 and 0.0001103 for local Rice production and price respectively for a given change in quantity of local Rice produced and price multiply by 100. The percentage change or growth rate in quantity of local rice produced and price for an absolute change in time is obtained. The growth rate of 0.00122% and 0.011 % for local Rice production and price respectively reveals that over the period of 1980 –

2016, the production and price of local Rice in Benue State increased at a point in time (in a year). The compound growth rate (r) were also calculated from point in time growth rates which are (0.00122 and 0.01103) as shown in the Table by taking the Antilog of b2

**Table 4.7: Point in time growth rate and compound growth rate for local Rice production and price in Benue State (1980 – 2016)**

| Parameter | Local Rice production | Price |
|---|---|---|
| β2 | 0.0000122 | 0.00011 |
| F(p-value) | 3.612(0.00431)* * | 2.360(0.00230)* * |
| Instantaneous Growth Rate | 0.00122 | |
| Compound Growth Rate | 1.36 | 0.011<br>1.258 |

Computed by researcher * * significant at 5% level

The growth trend of local Rice production and price in Benue State per years within the Period of the study time (point growth rate) were 0.0000122 and 0.0001103. In a related development, the compound growth rates for 1980 – 2016 were 1.36% and 1.26% respectively. The mean quantity of rice produced and price differ within the period under investigation. The study agrees with the work of Onu *et al.*( 2015) and Ojoehemon *et al. (2009)* noted that production and demand of local Rice has increased with demand outstripping local Rice cultivation. The result of this study shows that the local Rice demand – supply gap has been in existence ever before now. Increase in production is the only solution through harnessing our local resources The policy implication include provision of early maturing local Rice varieties and provision of irrigation facilities to supplement rainfall..

### 4.2.6 Local rice supply structural break points in Benue State data series

Structural break point in data series is sudden shift in the time series data. This could be increase due to implementation of policies to boost production. There may also fall in production due to disasters like drought, flood pest and dieses attack In Benue State data

of Rice production 1980-2016, structural break points were indicated. Structural break has its null hypothesis as; H0. There is no structural break in the data series. Using ADF test to identify the breaks. When the p-value of ADF is less than 5% critical value, it means the series has breaks. In this data series the ADF p-value is 0.06373. Therefore the alternative hypothesis was accepted, and concluded the series has structural breaks as detailed in the figure 4.10 below

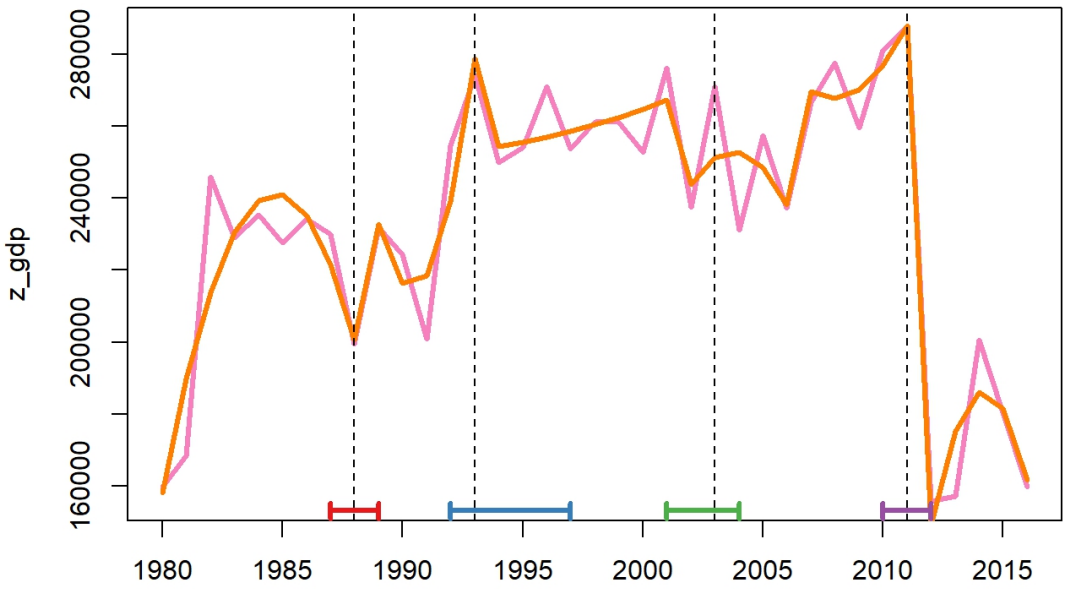



Figure 4.13 Structural break points in Benue State 1980-2016
Source: Benue Agricultural and Rural Development Authority

The structural breaks in Benue State in 1987 may be due to flood that washed away the Rice farms. This was as a result of heavy rainfall that washed away the planting materials, and displaced many farmers away from their homes. The production started increasing may be as a result of introduction of Agricultural policies that boosted the local Rice production in 1993-1994. In 2003 there was heavy flood that washed away

lands which affected rice production. The scenario of flood continued to repeat itself covering 2004. Now the production has improved with the introduction of dry season farming through Agricultural transformation agenda, Anchor borrowers' program.

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### 4.3 Stationarity Test on Local Rice Supply Variables in Niger State

The integration test has to do with the stationarity of all-time series data. Stationarity is the stochastic properties of the time series data moving round the mean. Its mean, variance of the mean and covariance of the mean are all stationary and do not change with time. Bannerjee (1993)arguered that factors like inflation and seasons make mean of the series to change with time. The Augmented Dickey Fuller (ADF) unit root test of stationarity was used to achieve this. The Augmented Dickey Fuller (ADF) unit root test of stationarity for Niger State is shown in Table 4.10. The explanatory variables of local rice production in Niger State (area, yield, price, fertilizer and rain) were not stationary at level but stationary at first difference. The series is of the same order of 1(1) in the first difference. The test statistics and P- value of dependent variables indicated that the null hypothesis was accepted at level 1(0)

**Table 4.8: Stationarity test for yearly Rice production variables in Niger State**

| Variables | Observation | Lag | ADFvalue | t-statistics (critical values) | Order level | P value |
|---|---|---|---|---|---|---|
| Production | 36 | 0 | 8.475 | 8..495 (2.972)*** | 1(1) | 0.000 |
| Area | 36 | 0 | 9.992 | 9.992 (2.618)*** | 1(1) | 0.000 |
| Yield | 36 | 0 | 7.046 | 7.016 (3.682)*** | 1(1) | 0.000 |
| Price | 36 | 0 | 4.894 | 4.894 (2.972)*** | 1(1) | 0.000 |
| Fertilizer | 36 | 0 | 6.717 | 9.169 (2.618)*** | 1(1) | 0.000 |
| Rain | 36 | 0 | 9.169 | 6.717 (3.62)*** | 1(1) | 0.000 |

Source; Study result output, 2017

Lag length were selected based on AIC
Critical values are significant at 1%
Argumented Dickey Fuller analysis carried out in Stata version 11.0

### 4.3.1 Result of co integration test in Niger State

Co-integration investigation was done using Johansen's test. The regression co-efficient were used to identify most significant vectors. The Johansen co-integration test for production of local Rice and production variables are shown in Table 4.11. The result for the production variables production, area, yield, price, fertilizer and rainfall shows that the null hypothesis of not co-integration vector (r = 0) was accepted at 1% level of significance.

**Table 4.9: Result of Johansen Co-integration analysis for local Rice production in Niger State**

| Variables | Null | Trace Test | Max Eigen | Critical value |
|---|---|---|---|---|
| Production | r = 0 | 258.92 | 0.97417 | 94.15*** |
| Area | r = 0 | 141.92 | 0.85918 | 68.52*** |
| Yield | r = 0 | 79.19 | 0.69142 | 47.21*** |
| Price | r = 0 | 41.57 | 0.44943 | 29.68*** |
| Fertilizer | r = 0 | 22.47 | 0.36673 | 15.41*** |
| Rain | r = 0 | 7.85 | 0.21757 | 3.76*** |

Source; Study Result output, 2017

(***) **indicates significance at (1%) and 5% level Number of observation =36 and lag number 4 variables.

### 4.3.2 Result of the Ordinary Least Square of Rice production in Niger State

The linear regression model was used to analyse the responsiveness of local Rice supply to changes in price and non-price factors. The chosen was based on the power of produced by $R^2$, a prior expectation and based on the statistical significance of the estimated regression coefficient. The prior expectation is that all the variables will be

statistically significantly and positively increase local Rice supply in Niger and Benue States.

Table 4.10Result of OLS for local Rice production in Niger State

| Variables | Co-efficient | Std. Error | t– ratio | P-value |
|---|---|---|---|---|
| Constant | -338703.1 | 130012.5 | -2.61 | 0.014** |
| Area(x1) | 1.535376 | 0.1968272 | 7.80 | 0.000*** |
| Yield(x2) | 140031.96 | 30060.96 | 4,66 | 0.000*** |
| Price(x3) | 3.724702 | 0.513891 | 7.25 | 0.000*** |
| Fertilizer(x4) | 1.18454124 | 0.589324 | 2.01 | 0.0482** |
| Rainfall(x5) | 312.188344 | 102.6936 | 3.04 | 0.000*** |
| R2 | 0.9425 | | | |

*** Significant at 1% level ** significant at 5% level of probability

$$Yt = -338703.1+1.535376x_1+140031.96x_2+3.724702x_3+1.18454124x_4+312.188344x_5 \quad (47)$$

The result revealed 94% of the variation in the level of local Rice production was explained by the independent variables included in the ordinary least square linear regression model indicated by $R^{2.}$This means 6.5%variation in the level of area expansion on local Rice supply was caused by factors not included in the model. The result indicated that area expansion (x1) was statistically significant at 1% and positively related to the local Rice supply response. The positive sign of the co-efficient is in agreement with the prior expectation, meaning that as area cultivated to local Rice increases the supply of local Rice increases too. The relationship could be attributed to

the fact that local Rice is a normal good and needed by household heads for local dishes called *Tuwo.* This agrees with the findings of Michael *et al.* (2015) who observed that increase in consumption of local Rice is because it is use in preparing local dishes.

The co-efficient of yield ($x_2$) was statistically significant at 1% and positively related to local Rice supply. This conforms to the a prior expectation, which means increase in yield reflected greatly on greater supply of local Rice in the market *ceteris paribus* increase the supply of local Rice to the market and price may be low The yield increase could be highly feasible because Nigeria local Rice producers are to tap fully the potentials of the available Rice technologies so far at their disposal. These lead to low productivities when compared to neighbouring countries (Tiamiyu *et al,* 2014). Improve productivity of local Rice by intensive production of adoption of improved Rice production technology among local Rice growers if the study areas are to meet the potential demand under good soil management and improve agronomic practices four tons of paddy can be obtained in 1 hectare of land under rain fed lowland and even more under irrigated production method (Usman *et al., 2014).*

The co-efficient of price ($X_3$) was statistically significant at 1% and positively related to local Rice supply. This agrees with a prior expectation. This means the higher the price of local Rice the higher the production and supply of local Rice to the market and the higher the revenue for the farmers. This also agrees with the study of Michael *et al., (*2015) that also observed that when the price of milled Rice goes higher the producers grow more local Rice to generate more income.

The co-efficient of fertilizer utilization on local Rice supply ($X_4$) was positive and statistically significant at 5% level. This conforms to a prior expectation. This means a

unit increase in the usage of fertilizer increase the supply of local Rice by 1.19%. Generally most local Rice growers are not economically powerful to make use of recommended rate. This affected the production and yield per hectare which in turn is responsible for low supply of local Rice.

The co-efficient of Rainfall ($X_5$) contributed highly to local Rice supply in Niger State. The co-efficient was statistically significant at 1% probability level and positive

### 4.3.3 Stationary test on local Rice supply variables in Benue State

Local Rice supply variables in Benue State were also subjected to stationarity test using ADF. The lags of production, fertilizer and rainfall were stationary at level. Area and yield were not stationary at level but differenced and stationary at first difference. The Table4.11 shows that only price was stationary at second difference.

Table 4.11. Stationarity test for yearly Rice production variables in Benue State**(1980 –** 2016)

| **Variables** | **Observation** | **Lags** | **ADFvalues** | **t-statistics (Critical value)** | **Order** | **P – value** |
|---|---|---|---|---|---|---|
| Production | 36 | 0 | 4.240 | 4.240 (2.969)** | 1(0) | 0.0006 |
| Area | 36 | 0 | 4.064 | 4.064 (2.969)** | 1(1) | 0.0011 |
| Yield | 36 | 0 | 6.264 | 6.264 (2.617)*** | 1(1) | 0.0000 |
| Price | 36 | 0 | 11.843 | 11.843 (2.969)*** | 1(2) | 0.0000 |
| Fertilizer | 36 | 0 | 4.805 | 4.805 (2.617)*** | 1(0) | 0.0001 |
| Rain | 36 | 0 | 3,903 | 3.903 (2.617)** | 1(0) | 0.0020 |

*** Significance at 1% and ** Significant at 5%

Source: Study result output, 2017

Lag length were selected based on AIC

Argumented Dickey Fuller analysis carried out in stata version 11.0

### 4.3.4. Granger causality test result for Benue State

The causality result are inferred from the $Chi^2$ and Pro-$chi^2$ shown in Table 4.14 Considering the Granger causality test result in the Table 4.14, production, area, yield and rain equations were statistically significant at 1% and were said to have granger caused local Rice production in Benue State. The price and fertilizer were not significant but overall total contribution was statistically significant at 1% level. This means that all the variables jointly Granger caused Local Rice Production in Benue State from 198

Table 4.12: Granger causality test result of Benue State

| **Equation** | **Excluded** | **$Chi^2$** | **pro> $Chi^2$** |
|---|---|---|---|
| Production | area | 88.324*** | 0.000 |
| Production | yield | 216.24*** | 0.000 |
| Production | Price | 1.543 | 0.819 |
| Production | fertilizer | 4.937 | 0.290 |
| Production | rain | 64.639*** | 0.000 |
| Production | all | 361.61*** | 0.000 |
| area | production | 100.05*** | 0.000 |
| area | yield | 121.48*** | 0.000 |
| area | Price | 1.9369 | 0.747 |
| area | fertilizer | 8.1803* | 0.085 |
| Area | rain | 82.049*** | 0.000 |
| area | all | 348.89*** | 0.000 |
| yield | production | 47.805*** | 0.000 |
| yield | area | 25.596*** | 0.000 |
| yield | Price | 27.184*** | 0.000 |
| yield | fertilizer | 40.255*** | 0.000 |
| yield | rain | 18.601*** | 0.001 |
| yield | all | 288.63*** | 0.000 |
| Price | production | 28.527*** | 0.000 |
| Price | area | 25.794*** | 0.000 |
| Price | Yield | 3.7999 | 0.434 |
| Price | fertilizer | 107.72*** | 0.000 |
| Price | rain | 15.672** | 0.003 |
| Price | all | 433.18*** | 0.000 |
| fertilizer | production | 2,9217 | 0.571 |
| fertilizer | area | 5.9070 | 0.206 |
| fertilizer | yield | 4.2635 | 0.372 |
| fertilizer | Price | 0.85578 | 0.931 |

| | | | |
|---|---|---|---|
| fertilizer | rain | 17.755** | 0.001 |
| fertilizer | all | 65.512*** | 0.000 |
| rain | Production | 12.857** | 0.012 |
| rain | area | 8.8694* | 0.064 |
| rain | yield | 7.8169* | 0.099 |
| rain | Price | 12.1** | 0.017 |
| rain | fertilizer | 10.324** | 0.035 |
| rain | all | 44,689** | 0.001 |

*** Significance at 1%, ** Significant at 5% and * Significant at 10%
Source: Study result output, 2017

– 2016. Therefore the null hypothesis that all the lag co efficient of production equation was zero was not accepted.

The result from the Table 4.14 shows that the lags co-efficient of area, yield, rain and fertilizer were statistically significant at 1% and 10% level, only price was not statistically significant. The joint contribution of all lag variables was also statistically significant at 1% level. This means that lags of area equation Granger caused local Rice production in Benue State. The null hypothesis that lags co efficient of area equation were zero was rejected.

Table 4.14 further reveals that lags co-efficient of yield equation were all statistically significant at 1% level. The lags co efficient were all said to have Granger caused local Rice production in Benue State. The null hypothesis that lags co efficient of yield were zero was rejected. All the lags co efficient of yield equation Granger caused local Rice production in Benue State. The Table 4.14 further indicated that in price equation production, area, fertilizer and rain were all statistically significant at 1% level and were said to have Granger caused local Rice production. The statistically non-significant lag co efficient was yield. All the lags co-efficient of price equation Granger caused local Rice production and was statistically significant at 1% level. The null hypothesis that lags co efficient of price were zero was not accepted

From the result it was inferred that all the lags do Granger caused local rice production, except rain. The rain and joint contribution of all lags variable co efficient in fertilizer equation were statistically significant at 1% level. This means that fertilizer also Granger caused local Rice production in Benue State. Above all, rain equation lags co efficient were statistically significant at 5% and10% level. All the co efficient Granger caused local Rice production in Benue State. The joint contribution of all lags co efficient in rain equation was statistically significant at 1% level. This is an indication that rain strongly Granger caused local Rice supply in Benue State.

Table 4.13: Normality Test of production variables, skewness, kurtosis and jarque-**Bera** test in Benue State

| | **Jarque-Bera test** | | **Test of skewness** | | **Test of kurtosis** | |
|---|---|---|---|---|---|---|
| Equation | **Chi$^2$** | **Prob.> chi$^2$** | **Chi$^2$** | **Prob. >chi$^2$** | **Chi$^2$** | **Prob. > chi$^2$** |
| Production | 0.477 | 0.78785 | 0.308 | 0.57895 | 0.169 | 0.68103 |
| Area | 10.395 | 0.00553 | 8.120 | 0.00438 | 2.275 | 0.13144 |
| Yield | 0.963 | 0.61786 | 0.148 | 0.70088 | 0.815 | 0.36652 |
| Price | 0.415 | 0.81263 | 0.234 | 0.62830 | 0.181 | 0.67088 |
| Fertilizer | 3.292 | 0.19281 | 3.138 | 0.07649 | 0.154 | 0.69465 |
| Rain | 26.042 | 0.00000 | 11.038 | 0.00089 | 15.004 | 0.00011 |
| All | 49.300 | 0.00010 | 29.257 | 0.00059 | 20.044 | 0.01764 |

Source: Benue Agricultural and Rural Development Authority, 2004

The area was significant at5% and rainfall was significant at1% while the total contribution reveals significant of 1%. This indicates that the variables were normally distributed

The result of normality tests, jarque-bera, skewness and kurtosis were significant at 1 and 5% respectively. This implies that the errors were normally distributed and the model is good. (Deaton and Muelbauer. 1980)

### 4.4 Estimated Effect of Short local Rice and long local Rice Prices on their Respective Expenditure Shares

The estimated parameters of the LA/ AIDS models for short and long grain local Rice in the study area are presented in Table 4.16. The F-statistics of the estimated short and long grain local Rice equations in Niger, Benue States and for the pooled data were all significant at 1% and this indicates the joint significance of the explanatory variables included in the various equations respectively. The R-squared values of 0.8961, 0.9743 and 0.9289 for short grain local Rice equations in Niger, Benue and pooled data respectively implies that 89.61%, 97.43% and 92.89% variations in the households' monthly budget share of short grain local Rice in the monthly food expenditure were explained by the variables included in the models. Also, the R-squared values of 0.7938, 0.9723 and 0.9206 for the long grain local Rice equations implies that 79.38%, 97.23% and 92.06% variations in the monthly budget share of long grain local Rice in the monthly food expenditure of households in Niger, Benue and in both States were explained by the variables included in the models.

In Niger State, the result presented in Table 4.16 reveals that the price of short grain local Rice at $p<0.01$, price of long grain local Rice at $p<0.01$, respondents' perception on taste and texture at $p<0.05$ and household monthly income were all significantly contributes to the proportion of households expenditure on short grain local Rice. In other word price of short grain local rice, price of long grain local Rice, perception on

taste and texture and monthly income make up the expenditure share of household. The result for long grain local Rice equation indicates that the price of short grain local Rice at p<0.01, price of long grain local Rice at p<0.01, and household size were the significant variables that influences the proportion of households expenditure on long grain local Rice. Meaning that price of short grain local Rice, price of long grain local Rice, household size were significant variables that contributes to the proportion of household expenditure on long grain local Rice.

More so, the short grain local Rice model for Benue reveals that price of short grain local Rice at p<0.01, price of long grain local Rice at p<0.01, perception on aroma of the Rice at p<0.01 and household monthly income (p<0.10) were the significant variables that influences the proportion of households' expenditure on short grain local Rice in the area. The pooled data result reveals that the price of short grain local Rice at p<0.01, price of long grain local Rice at p<0.01and perception on aroma of the

local Rice at p<0.05 were the significant variables that influences the share of households' expenditure on long grain local Rice.

In the pooled data, the result reveals that the price of short grain local Rice at p<0.01, price of long grain local Rice at p<0.01, household expenditure at p<0.01, respondents' perception on aroma of the local Rice at p<0.10 and taste and texture at p<0.10 as well as the household size at p<0.05 were all significant and made up the share of households expenditure on short grain local Rice. Also, the long grain local Rice function reveals that price of short grain local Rice at p<0.01, price of long grain local Rice at p<0.01, respondents' perception on the taste and texture of the local Rice at p<0.10 as well as the household size at p<0.05 were the significant variables that contributes to the proportion of households expenditure on long grain local Rice. It is

noteworthy that the co-efficient of the price of short grain local Rice was significantly negative and that of the substitute long grain local Rice was significantly positive in influencing the share of the expenditure on short grain local Rice. This implies that an increase in the prices of short grain local Rice will reduce households' expenditure share of short grain local Rice while increase in the price of the substitute, long grain local Rice will lead to increase in the households' expenditure share of short grain local Rice *ceteris paribus*. Similarly, co-efficient of the price of long grain local Rice was significantly negative and that of the substitute short grain local Rice was significantly positive in contributing to the share of the expenditure on long grain local Rice. This implies that *ceteris paribus,* an increase in the prices of long grain local Rice will reduce households' expenditure share of long grain local Rice while increase in the price of the substitute, short grain local Rice will lead to increase in the expenditure share of long grain local Rice. More so, household size and annual income was found to influence the share of both the short and long grain local Rice expenditure. This finding is similar to those of Omonona *et al*. (2009) and Oyinbo, (2014) reported that price of the commodity, household size and annual income significantly contributes mostly to the expenditure share of Rice consumers in Kaduna State. The study also corroborates the works of (Uchenna and Lioyd. 2018) and (Oladimeji.2017) that annual income contributes positively to the expenditure share of households especially for normal good like Rice. The contribution was negative for inferior good.

**Table 4.14 Estimates of the LA/Almost Ideal Demand System ( LA/AIDS) Model for Niger**

| Area | Rice category | A | $\gamma_i$ (price of short grain rice) | $\gamma_j$ (price of long grain rice) | $\beta_i$ (expenditure ) | (aroma) | (taste and texture) | $\alpha_{ij}$ (household size) | $\alpha_{ij}$(monthly disposable income) | $R^2$ | F-value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Niger | Short grain | -0.8822 (-3.52***) | 0.0921 (6.38***) | 0.1874 (13.19***) | -0.1235 (-11.29***) | 0.0097 (0.47) | 0.2324 (2.27**) | 0.0065 (1.46) | 0.0102 (4.79***) | 0.8961 | 144.20*** |
| | Long grain | 1.2716 (3.62***) | 0.0685 (14.78***) | -0.0285 (-12.00***) | -0.0515 (-2.48**) | -0.0094 (-0.32) | -0.1945 (-1.34) | 0.0155 (2.53**) | 0.0006 (0.17) | 0.7938 | 64.34*** |

Note: *** = p<0.01, ** = p<0.05 and * = p< 0.10 probability level; figures in parenthesis are t-values

Source: field survey, 2017

**Table 4.15 Estimates of the LA/Almost Ideal Demand System ( LA/AIDS) Model for Benue**

| Area | Rice category | A | $\gamma_i$ (price of short grain rice) | $\gamma_j$ (price of long grain rice) | $\beta_i$ (expenditure ) | (aroma) | (taste and texture) | $\alpha_{ij}$ (household size) | $\alpha_{ij}$(monthly disposable income) | $R^2$ | F-value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Benue | Short grain | 0.5079 (0.95) | -0.0517 (-12.64***) | 0.0454 (10.37***) | -0.0110 (-3.44***) | 0.0462 (2.63***) | -0.0331 (-0.14) | -0.0041 (-1.12) | -0.0036 (-1.71*) | 0.9743 | 800.76*** |
| | Long grain | 0.4257 | 0.0650 | -0.0307 | -0.0014 | -0.0458 | 0.0427 | 0.0039 | 0.0030 | 0.9723 | 740.84** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (0.77) | (36.13***) | (-28.11***) | (-0.44) | (-2.51**) | (0.18) | (1.02) | (1.35) | | * |

Note: *** = p<0.01, ** = p<0.05 and * = p<0.10 probability level; figures in parenthesis are t-values

Source: field survey, 2017

**Table 4.16 Estimates of the LA/Almost Ideal Demand System (LA/AIDS) Model for Pooled**

| Area | Rice category | A | $\gamma_i$ (price of short grain rice) | $\gamma_j$ (price of long grain rice) | $\beta_i$ (expenditure) | (aroma) | (taste and texture) | $\alpha_{ij}$ (household size) | $\alpha_{ij}$(monthly disposable income) | $R^2$ | F-value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pooled data | Short grain | -0.0722 (-0.31) | -0.0386 (-7.30***) | 0.0600 (10.75***) | -0.0242 (-5.77***) | 0.0311 (1.92*) | 0.1871 (1.84*) | -0.0067 (-2.05**) | 0.0020 (1.20) | 0.9289 | 509.63** * |
| | Long grain | 0.9584 (3.84***) | 0.0682 (33.79***) | -0.0280 (-29.17***) | -0.0049 (-1.10) | -0.0276 (-1.61) | -0.1907 (-1.78*) | 0.0088 (2.52**) | -0.0014 (-0.75) | 0.9206 | 452.25** * |

Note: *** = p<0.01, ** = p<0.05 and * = p<0.10 probability level; figures in parenthesis are t-values

Source: field survey, 2017

### 4.4.1Expenditure elasticities of short and long grain Rice in the study area

The expenditure elasticity measures the responsiveness of consumer's expenditure on certain commodity with respect to change in income. The short local Rice and long local Rice expenditure elasticity estimates are presented in Table 4.17. The results indicates that both short local Rice and long local Rice are normal goods as shown by the positive sign of their expenditure elasticities. It also further indicates that the two commodities were expenditure inelastic as their expenditure elasticities were less than one in Niger, Benue and pooled data. This means that both the short local Rice and long local Rice are normal goods in the households' food baskets in the areas. The implication of this is that an increase in the households' monthly incomes will lead to a less than proportionate increase in their demand for short local Rice and long local Rice. Also decrease in monthly income of households will produce less than proportionate decrease in the demand for short local Rice and long local Rice. This result is in contrast of that of Omonona *et al.*(2009) reported that local Rice is an inferior good in South-West Nigeria. It however conforms to the findings of Oyinbo, (2014) that reported that Rice is a normal good in the food baskets of households in Kaduna State. As it is necessity and expenditure inelastic in Borno and Ogun States respectively.

**Table 4.17: Expenditure elasticities of short and long localRicein the demand system**

| Rice category | Niger State | Benue State | Pooled data |
|---|---|---|---|
| Short local Rice | 0.5349 | 0.9231 | 0.8775 |
| Long local Rice | 0.9298 | 0.9983 | 0.9939 |

Source: Field survey, 2017.

### 4.4.2. Uncompensated demand elasticities of short and long local Rice in the area

The result presented in Table 4.18 shows that the uncompensated own price elasticities of short and long grain local Rice in Niger, Benue and pooled data had the expected negative signs and were price elastic except for Niger where both commodities were found to be price inelastic. This implies that a unit increase in the prices of short anlong grain local Rice in the area will lead to more than proportionately decrease their demand by a unit of their respective elasticity values, *ceteris paribus*. Implies that a unit increase in price of short and long grain local Rice will in Benue State reduce the demand for short and long local Rice by more than 1.35 for short, and 1.03 for long local Rice respectively. However, unit increase in the prices of short and long grain local Rice in Niger will yield less than proportionately decrease the demand for the commodities respectively. This finding is in contrast to the findings of Oyinbo, (2014) who reported that Rice and its substitutes were price inelastic in Kaduna State. This implies either increase or decrease in prices does not increase or decrease the quantity demanded by the same margin, because Rice is a normal good.

The result in Table 4.18 further reveals that all the estimated cross-price elasticities of short and long grain local Rice were found to be positive. The positive cross-price elasticities of short and long grain local Rice indicates substitutability, which implies that an increase in the price of short grain local Rice causes an increase in the quantity of long grain local Rice demanded and vice versa. The result corroborates (Gideon *et al*.2014) argued that Rice is normal goods in Kaduna State and increase or decrease in price does not lead to proportionate increase or decrease in quantity demanded

**Table 4.18: Uncompensated Own and Cross Price Elasticities of Short and Long local Rice**

| Study Area | Rice category | Own price elasticity | Cross price elasticity |
|---|---|---|---|
| Niger State | Short local Rice | -0.5296 | 1.0474 |
| | Long local Rice | -0.9873 | 0.1119 |
| Benue State | Short local Rice | -1.3517 | 0.3842 |
| | Long local Rice | -1.0344 | 0.0761 |
| Pooled data | Short local Rice | -1.1713 | 0.4021 |
| | Long local Rice | -1.0300 | 0.0862 |

Source: Field survey, 2017.

### 4.4.3. Hicksian compensated demand elasticities of short and long local Rice

The result presented in Table 4.19 shows that the compensated own price elasticities of short and long grain local Rice in the Niger, Benue and pooled data had the expected negative signs and were price inelastic except for short grain local Rice in Benue that was found to be price elastic. This implies that a unit increase in the prices of short and long grain local Rice in the area will leads to less than proportionately decrease their demand by a unit of their respective elasticity values *ceteris paribus*. However, a unit increase in the price of short grain local Rice in Benue will bring more than proportionately decrease its demand. This finding is similar to the findings of Oyinbo (2014) reported that Rice and its substitutes were price inelastic in Kaduna State. It is also similar to of Baba (2007) and Otunaiya and Shittu (2014) who both reported that fruits and vegetables including Rice were price inelastic in Borno and Ogun States respectively.

Also, the result further reveals that all the estimated cross-price elasticities of short and long grain local Rice were found to be positive. These positive cross-price elasticities of

these commodities indicated substitutability and implying that an increase in the price of short grain local Rice causes an increase in the quantity of long grain local Rice demanded and vice versa in the study area. Implies that increase in price of short grain local Rice will make consumers to shift to consumption of long grain local Rice. This means increase in expenditure share of long local Rice and decrease in expenditure share of short grain local rice.

**Table 4. 19: Compensated own and cross price elasticities of short, long local Rice**

| Study area | Rice category | Own price elasticity | Cross price elasticity |
|---|---|---|---|
| Niger State | Short local Rice | -0.3876 | 1.4402 |
| | Long local Rice | -0.3044 | 0.3588 |
| Benue State | Short local Rice | -1.2201 | 1.1756 |
| | Long local Rice | -0.1784 | 0.2184 |
| Pooled data | Short local Rice | -0.9982 | 1.1065 |
| | Long local Rice | -0.2322 | 0.2823 |

Source: Field survey, 2017.

### 4.5 Effect of Quality Characteristics on Local Rice Consumption and price

The results of the Hedonic model of quality characteristics for local Rice were presented in Table 4.18. $R^2$of 0.70 implies that 70% in the variability in the price consumers are willing to pay for quality local rice characteristics in Niger State is explained by the explanatory variables. These variables are whiteness, aroma, stone free, education level, household size and disposable income specified in the model was significant at 0.04 probability level and this shows the significance of the variables on the price of local Rice in Niger State suggesting that the model has a good explanatory power on the variation in the model. The prior expectation is that as the qualities of local Rice is maintained consumers will patronize it and importation will stop.

The qualities of local Rice play important role in consumer's willingness to pay higher price. From the Hedonic price analysis aroma had negative co-efficient (-220.3) and is significant. The reason is that aroma allows the consumers to choose from alternative local Rice in the market. The negative sign shows reduction in the price of local Rice without good aroma. The finding is consistent with the work of Diagne *et al*. (2017) that Rice with aroma attracted consumers to pay higher price and Rice with aroma are mostly patronized by richer countries.

Long local Rice grain, whiteness of the grain, stone free, cohesion of grain after cooking, education level, disposable income and household size were all statistically significant and affected consumer's interest to much or less money for a particular local Rice. Long local Rice (1.1505) was significant at 10% level of probability with a positive co-efficient. This means that as the length of local Rice looked long and attractive, it positively motivates consumers to pay higher price in Niger State. This also corroborates with the findings of Diagne *et al*. (2017) who found that attributes such as size and length of Rice grain were all very important to the consumers in Thailand and Pakistan. This therefore motivates the consumers to pay higher price. Whiteness of the local Rice was significant at 5% probability level with a positive co-efficient. This indicates that consumers are willing to pay more or increase the price of local Rice that is clean and white. The rice that is stone free (25.15) was significant at 5% and positive co-efficient. This also shows that consumers were willing to pay more for local rice devoid of stone. This work also agrees with the findings of Hassan, (2017) who confirmed that clean white local rice devoid of stone compete favourably with foreign Rice in terms of acceptability and higher price.

The result also revealed that all the socioeconomic characteristics were statistically significant. The education level, annual income and household size were significant at 5% and 1 percent respectively. This showed that education, annual income and household size also have significant effect on consumer willingness to pay for local rice quality characteristics. This also means that a unit increase in annual income and one person increase in household size will increase the expenditure and interest of more local Rice by 23.3 and 39.0 respectively. Cohesion (175.9) was significant at1% and positive. This means that the more the local Rice cohesion after cooking the more consumers are willing to pay.

**Table 4.20: Hedonic regression analysis of local Rice characteristics in Niger State**

| Variables | Coefficients | Std Error | / t/ | P |
|---|---|---|---|---|
| Constant | 147.2668 | 169.303 | 0.86 | 0.100 |
| Short local Rice | 0.0139674 | 0.0140982 | 0.99 | 0.324 |
| Long local Rice | 0.011505* | 0.00645393 | 1.77 | 0.085 |
| Cooking time | -19.03287 | 97.25678 | 0.20 | 0.845 |
| Whiteness | 179.224** | 104.2789 | 1.72 | 0.049 |
| Aroma | -220.3* * * | 134.7316 | 1.64 | 0.000 |
| Taste | 69.42252 | 68.1s9985 | 1.01 | 0.919 |
| Stone free | 166.64** | 103.5108 | 1.61 | 0.017 |
| Cohesion of Rice | 175.86*** | 97.75817 | 1.80 | 0.009 |
| Educational level | 28.23939** | 14.65302 | 1.93 | 0.056 |
| Gender | 10.92963 | 108.5633 | 0.10 | 0.920 |
| Annual income | 23.3*** | 14.21383 | 1.66 | 0.000 |
| Household size | 39.042*** | 24.13211 | 1.62 | 0.000 |
| Diameter | -10.89512 | 63.65422 | -0.77 | 0.864 |
| $R^2$ | 0.70 | | | |
| Adjusted $R^2$ | 0.66 | | | |
| F- statistics | 12.112* * * * * | | | |

*** Significant at 1%, ** Significant at 5% and * Significant at 10%
Source: Field survey data 2017

### 4.5.1 Result of Hedonic of local Rice Characteristics as it Affects Price

Hedonic result estimates of quality attributes as it affect willingness to pay for local Rice in Benue State is presented in Table 4.19. The $R^2$ of 0.88 means 88% variability in

the local Rice consumers' willingness to pay for good attributes in Benue State is explained by the explanatory variables in the model. The F-statistic was 12.14 and was statistically significant at 0.01 probability level. This indicates that the joint significance of the variables on the price of local Rice in Benue State shows that the model has a good explanatory power on the variables.

**Table 4.21: Hedonic regression analysis of local Rice characteristics in Benue State**

| Variables | Coefficient | Std Error | / t / | P |
|---|---|---|---|---|
| Constant | 1666.927*** | 980.389 | 1.7 | 0.000 |
| Short local Rice | 0.035** | 0.015 | 2.30 | 0.023 |
| Long local Rice | 0.010** | 0.005 | 2.0 | 0.037 |
| Cooking time | 12.98 | 99.86 | 0.12 | 0.196 |
| Whiteness | 140.9** | 88.52 | 1.59 | 0.039 |
| Aroma | 14.32 | 14.55 | 0.98 | 0.326 |
| Taste | 33.41 | 32.46 | 1.03 | 0.305 |
| Free from stone | 42.55 | 85.18 | 0.49 | 0.618 |
| Cohesion | 147.4* | 88.77 | 1.66 | 0.081 |
| Education level | 40.25*** | 14.74 | 2.73 | 0.007 |
| Gender | -21.59 | 12.25 | -1.76 | 0.180 |
| Annual income | 35.72** | 18.35 | 1.95 | 0.053 |
| Household size | 43.05*** | 26.09 | 1.65 | 0.000 |
| Diameter | 34.02 | 84.30 | 0.40 | 0.687 |
| $R^2$ | 88 | | | |
| Adjusted $R^2$ | 84 | | | |
| F – statistics | 12.14*** | | | |

*** Significance at 1%, ** Significant at 5% and * Significant at 10%
Source: Field survey data 2017

Result in Table 4.19 indicates that short grain local Rice, long grain local Rice, cohesion, education level, and annual income were all statistically significant. The short grain and long grain local Rice were both statistically significant at 5% (0.023 0.03) probability level. This showed that the consumers were indifferent to long and short

grain local Rice in Benue State, provided the Rice has other needed attributes. Brightness of the local Rice grain (140.9) was significant at 5% probability level. This means the more the local Rice grain appear to be white, the more it affect the consumers' willingness to pay or consumer only pay high price for such local Rice. This research finding corroborates the findings of Cuevas *et al.*(2016) that argued that those local Rice grains with white appearance generally represent good characteristics in many Rice market segments and thus, those local Rice grains attracts higher market prices

Cohesion (147.4) was also statistically significant at 10% probability level and positively affected consumer willingness to pay for Rice. Consumers complained that cohesion makes boiled Rice marshy and spoil within a short period. All the socioeconomic characteristics were also statistically significant. Education was significant at 1 % and has positive sign. This means that the higher the educational level the more consideration of good attributes of local Rice. This work is in agreement with the findings of Anyanwu *et al*. (2017) reported that 20 percent of respondents that attended tertiary institution were more efficient in willingness to pay for local Rice with higher quality. Annual income (35.72) was statistically significant at 5% probability level. Higher annual income positively affects the willingness to pay for quality attributes above the margin of local Rice price. This corroborate with the work of Cuevas *et al*. (2016) who grouped the respondent annual income into low, middle and high income and confirmed that higher income class were willing to pay higher premium than other groups.

**Table 4.22: Hedonic regression analysis of local Rice characteristics for pooled**

| Variable | Coefficient | Std Error | /t/ | P |
|---|---|---|---|---|
| Constant | 557.5*** | 549.46 | 1.56 | 0.001 |
| Short L/Rice | -0.017 | -0.017 | 1 | 0.299 |
| Long L/R ice | 0.006 | 0.005 | 1.2 | 0.299 |
| Cooking time | 22.403* | 14.09 | 1.59 | 0.083 |
| Whiteness | 37.41** | 18.11 | 2.07 | 0.048 |
| Aroma | -16.25 | 27.53 | -0.59 | 0.560 |
| Taste | -24.41 | 23.41 | -1.04 | 0.306 |
| Stone free | 36.78** | 16.16 | 2.28 | 0.031 |
| Cohesion | 27.37 | 170.72 | 0.16 | 0.120 |
| Education level | -27.15 | 26.07 | -1.04 | 0.306 |
| Annual income | 54.55*** | 31.35 | 1.74 | 0.000 |
| Household size | 63.55*** | 41.53 | 1.53 | 0.000 |
| Diameter | 21.18 | 93.03 | 0.23 | 0.82 |
| R2 | 0.80 | | | |
| Adjusted R2 | 0.77 | | | |
| F – statistics | 19.28*** | | | |

*** Significance at 1%, ** Significant at 5% and * Significant 10%
Source: Field survey data, 2017

Result of regression measures of the factors affecting preference for good attributes for the pooled presented on Table 4.20. The $R^2$ of 0.80 means 80 percent in the variability in the local Rice consumers' willingness to pay for good attributes in both Niger and Benue States were explained by the explanatory variables in the model. Table 4.20shows F-statistics of 19.28 that implies the joint significant of the variables on the

price of local Rice in both Niger and Benue State showed that the model has a good explanatory power on the variation of the model.

Result in the Table 4.20 showed that whiteness, stone free, and annual income were all statistically significant. The whiteness (37.43) was significant at 0.049 probability level. This means that the whiteness of local Rice motivate and positively affects the consumers' willingness to pay for the Rice. This also agrees with the findings of Uchenna.and Lioyd. (2018) that confirmed that whiteness and clean package of local Rice grain command higher price and consumers' willingness to pay more premium. Stone free of local Rice (36.78) was also significant at 5% (0.031) probability level and positively affected consumers' interest to pay for local Rice. The socioeconomic characteristics (annual disposable income of the consumers and household size were statistically significant. This implies that more improvement on the qualities of local Rice increases the price of local rice by 54.55 and 63.55 respectively.

**4.6 Inhibiting Factor Associated with Consumption of Local Rice in Niger State**

Product quality characteristics are the foundation for consumers' demand and consumption for a particular product. Similarly, for consumers to like and prefer a product, that product must have characteristics that are very important and unique to attract consumers' attention. The inhibiting factors were ranked from $1^{st}$-$8^{th}$. The inhibiting factor with the smallest mean rank score is considered to be the most inhibiting factor. The general consumers' consensus on factors inhibiting the demand and consumption of local Rice was not available in Niger State. The target is to formulate the basic information on consumers' perception so that there would be available information for policy makers.

The result presented in Table 4.23 shows that 62% of the respondents agreed that, local rice that contain stone, impure Rice, broken grains, poor aroma, poor taste, and rice with debris low swollen ability and presence of foreign materials were inhibiting factors of local Rice. The presence of stone in local Rice was ranked 1st most inhibiting factor that makes local rice less attractive. There will be increase in consumption when local rice is properly processed, and will compete freely with its imported counterpart. The research corroborate work of Abubakar *et al*. (2013) and Abubakar *et al*. (2015) both in the findings argued that respondents' unpleasant crushing stone during consumption is not only the problem but also unhygienic due to the fact that consumption of stone causes appendicitis. This may lead to death of the consumers. Abubakar *et al.*(2015) also emphasized that poor aroma that was ranked 2nd as a factor that inhibited the demand of local Rice and factors that makes the consumers to patronized the imported rice This agrees with the findings of Alhassan *et al*.(2015) who confirmed that fragrance Rice was consumed mostly for the aroma that is perceives after cooking local Rice.

In Table 4.21, well processed local Rice grain was very important as impure local Rice grain was ranked 3rd most influential inhibiting factor, followed closely by broken Rice which was ranked 4th. Taste of local Rice grain, rice with debris were ranked 5th and 6th respectively as indicated in Table 4.21 which also agrees with the findings of Abubakar *et al*. (2015) . The last rank of factor inhibiting the demand and consumption of locally produced Rice by household were low swelling ability and presence of debris or foreign materials. These inhibiting factors have the mean scores of 6.55 and 7.11 respectively. This also corroborated the findings of Mottaleb *et al*. (2016) who pointed out that utility

drive and physical appearance of the local Rice grain were powerful qualities that make the consumers to decide to buy or not.

**Table 4.23: Factors inhibiting local Rice Consumption in Niger State with mean and rank Scores**

| Inhibiting factors | Mean scores | Rank scores |
|---|---|---|
| Contain stone | 1.84 | 1st |
| Aroma | 3.50 | 2nd |
| Impure local Rice | 3.84 | 3rd |
| Broken local rice | 4.03 | 4th |
| Taste | 4.19 | 5th |
| Rice with debris | 4.94 | 6th |
| Low swollen capacity | 6.55 | 7th |
| Foreign materials in Rice | 7.11 | 8th |

Source: Field survey, 2017

The result presented in Table 4.24 indicated that 62% of the respondents agreed that local Rice inhibiting factors were presence of stone, poor aroma, poor taste, broken Rice, rice with debris, low swelling ability and presence of foreign materials. The result in Table 4.24 revealed that presence of stone in local Rice has mean score of I.38 and was ranked 1st. This means that it is the first most inhibiting factor that limited the demand and consumption of local Rice. Ranked next is poor aroma and impure Rice. These have mean score of 3.30 and 3.73 respectively. They were ranked 2nd and 3rd most important inhibiting factors for local Rice utilization. This corroborates the work of Diako *et al*. (2010) confirmed that consumers buy local rice because of the notable aroma. This means that local Rice with impurities and poor aroma would likely experience very poor patronage.

In Table 4.24, broken local rice grain and poor taste were ranked 4th and5th in Benue State with mean rank scores of 4.00 and 5.13 respectively. This revealed that the consumers prefer full grain Rice with taste. This work disagreed with the findings of Diagne *et al*. (2017) who confirmed that about 77% of the respondents prefer broken Rice grain to whole – grain. The presence of foreign materials and low swelling ability were ranked 6th and 7th with mean rank scores of 5.84 and 6.23 respectively. The study also reveals that Rice with debris was ranked 8th inhibiting factor with the mean rank score of 6.37. This corroborate the findings of Hassan,(2017) who confirmed that quality characteristics like very clean white local Rice have positive and significant impacts on buying local Rice. Better taste and good clean appearance were the two main features of high quality local Rice.

**Table 4.24: Inhibiting factors of local Rice in Benue State with mean and rank Scores**

| Inhibiting factor | Mean scores | Rank scores |
|---|---|---|
| Presence of stone | 1.38 | 1st |
| Poor aroma | 3.30 | 2nd |
| Impure local Rice | 3.73 | 3th |
| Broken grain | 4.00 | 4th |
| Poor taste | 5.13 | 5th |
| Foreign materials | 5.84 | 6rd |
| Low swelling ability | 6.23 | 7th |
| Local Rice with debris | 6.37 | 8th |

Source: Field survey, 2017

As indicated in Table 4.25 inhibiting factors of local in (pooled) 62% of the respondents reveals, presence of stone, poor aroma, poor taste and broken grain were inhibiting factors of local Rice in Niger and Benue State. Other inhibiting factors include Rice

with debris, impure local Rice, low swelling capacity and presence of foreign materials, Presence of stone in local Rice, poor aroma and impure local Rice were ranked 1st, 2nd and 3rd respectively. The study corroborates the findings of Abubakar *et al*. (2015) and Dennis *et al,* (2017) pointed out that, good clean local Rice grain were most influential attributes and emphasized proper handling of local Rice that could lead to exportation. Broken local rice grain and poor taste have mean scores of 4.02 and 4.72 and were ranked 4th and 5th inhibiting factors respectively. This also agrees with the work of Dennis *et al*. (2017) argued that broken local rice grain and poor taste make local Rice unattractive to the consumers. Local Rice with debris, low swelling ability and presence of foreign materials were ranked 6th, 7th and 8th. The study is in line with the work of Hassan, (2017) that emphasized clean local Rice were motivating factors that attracts consumers. The effects of these factors in eating local Rice revealed that both clean and full length long local Ricegrain have impact on increasing good characteristics of local Rice.

**Table 4.25:Pooled inhibiting factors with mean and rank scores**

| Inhibiting factors | Mean rank scores | Ranks |
|---|---|---|
| Presence of stone | 1.58 | 1st |
| Poor aroma | 3.39 | 2nd |
| Poor taste | 4.72 | 5th |
| Broken local Rice | 4.02 | 4th |
| Local Rice with debris | 5.73 | 6th |
| Impure local Rice | 3.78 | 3rd |
| Low swelling ability | 6.37 | 7th |
| Foreign materials | 6.41 | 8th |

Source: Field survey, 2017.

### 4.6.1 Test of hypothesis

Kendall's coefficient of concordance was used to assess whether or not consumers identify differences between the mentioned local Rice inhibiting factors. The result was presented in Table 4.23. The result reveals significance level of 0.000. The calculated F – statistics was 41.3. The null hypothesis that local Rice characteristics have no significant effect on price was not accepted. Thus, alternative hypothesis was accepted. The Kendall's coefficient of concordance analysis shows that 62% of the sampled consumers were in total agreement with each other in both Niger and Benue States, that local Rice characteristics have significant effect on price.

**Table 4.26: Factors Inhibiting Consumption of Local Rice Hypothesis Testing**

| **Test Statistics** | **Estimated value** |
|---|---|
| N | 281 |
| Kendall's W | 0.62 |
| F- calculated | .41.3 |
| F critical | 0.000 |

Source: Field survey, 2017

# CHAPTER FIVE

## 5.0 CONCLUSION AND RECOMMENDATIONS

### 5.1 Conclusion

The study indicated that growth rate of local Rice were low in Niger and Benue States this mean low supply response to price.The price contributed less but non – price variables have great influence on production and supply of local Rice in Niger and Benue States from the OLS and granger causality results. These variables include area, fertilizers and rainfall. The result reveals that local Rice is normal goods and expenditure inelastic; cross price elasticity positive; compensated elasticity negative and price inelastic. The quality attributes of local Rice were also significant, indicating great influence on price premium to be paid for such characteristics from Hedonic result. These attributes are stone free Rice, white clean Rice, Rice with aroma, Rice with good taste and texture, non – broken Rice. Others include cohesion, well swollen ability and short cooking time of local Rice. Presence of stone, Rice without aroma; impure Rice and broken grain were inhibiting factors of local Rice. Furthermore poor taste, low swollen ability and presence of foreign materials were revealed by Kendall's coefficient of concordance as inhibiting factors of local Rice in the study areas.

### 5.2 Recommendations

From the result of the study, the following recommendations were made

1. It is revealed from the exponential trend equation that production of local rice is low, this cannot meet demand so credit institutions should make available loan to producers, consumption and marketing loans to farmers to expand production, processing and stores for storage of products to avoid false sales
2. It was observed that variables such as fertilizers and rainfalls contribute highly to production of local Rice, stakeholders, Development partners, financial institutions and non-governmental organizations should come to aid of the producers by making available subsidies of inputs and give out loan or credit to boost rice production and also make storage facilities affordable.
3. Grain quality characteristics attract higher price from the consumers, so producers and processors of local Rice should be trained on the best ways of harvesting and processing method for local rice to be widely acceptable.
4. In research or researchers in universities and research institutes be encouraged to breed varieties that have potentials characteristics needed by consumers such as long grain local Rice with short cooking time.
5. White clean local Rice devoid of stones with notable characteristics like non – broken long grain has the potentials of attracting consumers, thus appropriate measures be taken by stakeholders, development partners and associations like RIFAN. These may include drying slabs, and good rice milling machines with de-stoner, should be made available to produce full length clean grains without stones
6. It was observed that producers of local Rice were old people, youths are running away from farm. Better policies, like credit farming, hiring of tractors be encouraged by federal and State ministries of Agriculture and Rural Development

to reduce the cost of production before harvesting and processing after harvesting to reduce drudgery and increase the profit.

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## APPENDICES

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION TECHNOLOGY, SCHOOL OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE

Dear Sir/Madam,

I am a ph'D student of the above mentioned University conducting a research on the Estimation of Local Rice Supply Response and Demand Preference in Niger and Benue States. I seek your kind and sincere response. I assure you that all information given to me will be used for the purpose of this research sorely and treated with high confidentiality.

Thank you,

NMA, Dauda Sanchita

SECTION A: IDENTIFICATION DETAILS

STATE ---------- Community ----------

L.G.A ----------

SECTION B

Socio-Economic Information

1. Name of the respondent ----------
2. Phone Number ----------
3. Gender : male ---------- Female ----------
4. Age ---------- Marital Status ----------
5. Size of household Members: Number of boys ----------
   Number of Girls ---------- Number of Wives ----------

   Dependent ----------

6. Education Attainment of Respondent
   i. Primary
   ii. Secondary
   iii. Higher Levels (Please Tick) Ph'D -------- Masters----------
   Degree ---------- HND ---------- NCE --------- OND ----------
   Others, specify ----------

7. Occupation of Respondent
   i. Farming ----------
   ii. Civil servant ----------
   iii. Bankers ----------
   iv. Business person ----------
   v. Company----------
   vi. Others, Specify ----------

8. If Working Class, Salary Grade Level of Respondents
   i. Civil servant level ---------- Step ----------
   ii. Private sector level ---------- Step ----------
   iii. Others specify ----------

9. Respondent's Income Annually/Monthly

   i. ----------
   ii. ----------
   iii. ----------
   iv. ----------
   v. ----------

10. Other Sources of Income for Respondent Monthly/ Annually

i. ----------
ii. ----------
iii. ----------
iv. ----------
v. ----------

11a Information on Expenditure of Respondents on Different Local Rice Qualities

Qualities Amount Spend per Week/ Month

| Local Rice Qualities | Naira/ Mudu Number Mudu | Naira/Bag (50kg bag) | Naira/Bag (100 KG) | Total Cost/Week Or Month |
|---|---|---|---|---|
| Short Grain | | | | |
| Long Grain | | | | |
| Whiteness Clean | | | | |
| Grain with Foreign Material | | | | |
| Total Cost Spent on Rice items in House | | | | |

11b Information on Expenditure of Respondent for Local Rice with aroma. Please indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|
| Do you know, consumers are always pleased with local Rice with aroma. | | | | |
| Do you know, consumers buy more of local Rice with aroma. | | | | |
| Consumers always want to eat Rice with aroma only. | | | | |
| Rice grains with aroma attract few consumers in the market. | | | | |
| Consumers do not buy and eat Rice with aroma at all. | | | | |
| Do you know, Rice with aroma is always expensive in the market? | | | | |

11c Information on Expenditure of Respondent for Local Rice with Taste and Texture. Please indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following statements

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|
| Do you know, consumers are always pleased with local Rice with Taste and Texture. | | | | |
| Do you know, consumers buy more of | | | | |

| | | | | |
|---|---|---|---|---|
| local Rice with Taste and Texture | | | | |
| Consumers always want to eat Rice with Taste and texture only. | | | | |
| Rice grains with taste and texture attract few consumers in the market. | | | | |
| Consumers do not buy and eat Rice with taste and texture at all. | | | | |
| Do you know, Rice with taste and texture is always expensive in the market. | | | | |

12a Information on Consumer's preference for Different Local Rice Characteristics and prices

| Local Rice Characteristics | Naira/ Mudu Number Mudu | Naira/Bag (50kg bag) | Naira/Bag (100 KG) | Total Cost/Week Or Month |
|---|---|---|---|---|
| Short Grain | | | | |
| Long Grain | | | | |
| Whiteness Clean | | | | |
| Grain with Aroma | | | | |

| | | | | |
|---|---|---|---|---|
| Grain with Foreign Material | | | | |
| Grain with Taste and Texture | | | | |
| Total Cost Spent on Rice items in House | | | | |

Characteristics Amount Spend per Week/ Month

12b.Indicate by the type of cooking period of Rice mostly preferred by you a. Short (1)

b. Medium (2) c. Long (3)

13. Mention all the types of local Rice grown in locality?

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------
7. ----------
8. ----------

14. Rank all the local Rice in accordance with your preference?

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------

7. ----------
8. ----------

15. In order of preference mention other quality characteristics in local Rice of your choice?

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------
7. ----------
8. ----------

16a. List all the Factors inhibiting the Demand of Local Rice in this Locality in order of importance

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------
7. ----------
8. ----------
9. 
10. 

16b. Information on presence of stone in local Rice indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following statements

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|
| Do you know, consumers are not pleased with Rice with stones? | | | | |
| Consumers buy less of Rice with stones | | | | |
| Consumers always do not want Rice | | | | |

| | | | | |
|---|---|---|---|---|
| with stones | | | | |
| Rice grains with stones attract only few poor consumers | | | | |
| Consumers do not buy and eat Rice with stones | | | | |
| Rice with stones is always cheap | | | | |

16c Information on poor aroma of local Rice, indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following statements

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|
| Do you know, consumers are not pleased with Rice with poor aroma? | | | | |
| Consumers buy less of Rice with poor aroma? | | | | |
| Consumers always do not want Rice with poor aroma? | | | | |
| Rice grains with poor aroma attract only few poor consumers | | | | |
| Consumers do not buy and eat Rice with poor aroma | | | | |
| Rice with poor aroma is always cheap | | | | |

16d Information on poor taste and texture of local Rice, indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following statements

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Do you know, consumers are not pleased with poor taste and texture? | | | | |
| Consumers buy less of Rice with poor taste? | | | | |
| Consumers always do not want Rice with poor taste | | | | |
| Rice grains with poor taste and texture attract only few poor consumers | | | | |
| Consumers do not buy and eat Rice with poor taste and texture | | | | |
| Rice with poor taste and texture is always cheap | | | | |

16e. Information on broken local Rice, indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following statements

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|
| Do you know, consumers are not pleased with broken Rice grain? | | | | |
| Consumers buy less of broken grains? | | | | |
| Consumers always do not want broken Rice grain | | | | |
| Broken Rice grains attract only few | | | | |

| | | | | |
|---|---|---|---|---|
| poor consumers | | | | |
| Consumers do not buy and eat broken Rice | | | | |
| Broken Rice is always cheap | | | | |

16f. Information on dull appearance of local Rice, indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following statements

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|
| Do you know, consumers are not pleased with dull appearance Rice grain? | | | | |
| Consumers buy less of dull Rice grains? | | | | |
| Consumers always do not want dull Rice grain | | | | |
| Dull Rice grains attract only few poor consumers | | | | |
| Consumers do not buy and eat dull grain Rice | | | | |
| Dull Rice grains is always cheap | | | | |

16g. Information on dirty Rice grain, indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following statements

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|
| Do you know, consumers are not pleased with dirty Rice grain? | | | | |

| | | | | |
|---|---|---|---|---|
| Consumers buy less of dirty Rice grains? | | | | |
| Consumers always do not want dirty Rice grain | | | | |
| Dirty Rice grains attract only few poor consumers | | | | |
| Consumers do not buy and eat dirty grain Rice | | | | |
| Dirty Rice grains is always cheap | | | | |

16h. Information on low swelling ability of local Rice, indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following statements

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|
| Do you know, consumers are not pleased with low swelling ability of Rice grain? | | | | |
| Consumers buy less Rice grains with low swelling ability? | | | | |
| Consumers always do not want Rice grain with low swelling ability | | | | |
| Rice grains with low swelling ability attract only few poor consumers | | | | |
| Consumers do not buy and eat grain Rice with low swelling ability | | | | |

| | | | | |
|---|---|---|---|---|
| Rice grains with low swelling ability is always cheap | | | | |

16i. Information on local Rice with foreign materials, indicate by ticking 'Agree' 'Disagree' 'Undecided' on the following statements

| Level of knowledge | Agree | Disagree | Undecided | Score |
|---|---|---|---|---|
| Do you know, consumers are not pleased with Rice grain with foreign materials? | | | | |
| Consumers buy less of Rice grains with foreign materials? | | | | |
| Consumers always do not want Rice grain foreign materials | | | | |
| Rice grains with foreign materials attract only few poor consumers | | | | |
| Consumers do not buy and eat Rice with foreign materials | | | | |
| Rice grains with foreign materials is always cheap | | | | |