FACTORS INFLUENCING ADOPTION OF IMPROVED RICE PROCESSING TECHNOLOGIES BY WOMEN IN CHANCHAGA AND BOSSO LOCAL GOVERNMENT AREAS IN NIGER STATE, NIGERIA

The study examined Factors Influencing Adoption of Improved Rice Processing Technologies by Women in Chanchaga and Bosso Local Government Areas of Niger State. The specific objectives were to: identify the socio- economic characteristics of the respondents, examine level of awareness, identify the sources of awareness, determine the level of adoption, factors influencing adoption and constraints to adopting improved rice processing technologies. Primary data were collected from 120 rice processors that were selected using purposive and proportionate sampling techniques from eight processing locations namely: Kpakungu, Gidan Mangoro, Dutse Kura, Tunga, Maikunkele, Bosso, Maitumbi and Chanchaga using structured questionnaire. Descriptive, probit regression model and Z-test were used as analytical tools. Results of the analyses reveals that respondents were at their productive age with mean age of 37 years. Respondents were aware of most the technologies and the sources of awareness were mostly extension agents, farmer groups and friends but few technologies were adopted. Result of the maximum likelihood estimates obtained from the probit regression analysis shows that age (0.016), education (0.041), labor cost (0.001), quantity processed (0.004), income (0.001), awareness (0.152) and co-operativeness were positive and significant with adoption of improved rice processing technologies. However, experience (-0.010) and extension agents (-0.281) were negative and significant while household size (-0.006) and distance (-0.051) were negative and insignificant with adoption of improved rice processing technologies. Also, Z-value ($p<0.05$) shows a significant difference between income before and after adopting the technologies. The most commonly mentioned constraints were inadequate access to agricultural credit and inadequate fund. Hence, adoption of improved rice processing technologies by processors is still low due to certain constraints not properly addressed. This study recommends that women should form more co-operatives so as to pull resources together to acquire needed technologies, financial institution should create an enabling environment for processors to loan and technologies developer should take into consideration the financial capacity of intended users.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Agriculture is the mainstay of Nigeria economy accounting for nearly 40 percent of Gross Domestic Product (GDP) and providing employment for the bulk of the labour force (Akande, 2000). However, the slow growth of agriculture and food production has resulted into growing food import and food insecurity. This is because, it is dominated by small scale resource poor farmers living in the rural areas with farm holding of 1-2 hectares which are usually scattered over wide areas (Ojo, Mohammed, Olaleye and Ojo, 2009).

The world is technologically driven and it is generally accepted that the remedy to the problem of low food production lies on the adoption of improved technologies by farmers. Technologies in this context refer to the collection of techniques and skills. It is the current state of humanity's knowledge of how to combine resources to produce desired products to solve problems, fulfill needs, or satisfies wants; it includes the technical methods, skills, processes, techniques, tools and raw materials (Wikipedia, 2011).

Rice is one of the oldest, celebrated and primary foods for more than half of the population of the world and the only cereal that is grown across most regions of the world (Issaka, Buri and Wakatsuki 2008). It is among the world's leading staple food crops and the sixth major crop cultivated after sorghum, millet, cowpea, cassava and yam in Nigeria

(Misari, Ojehomon, and Singh 1997) but if placed on a social scale can as well rank first because it is no longer a festive food but the staple for the urban and the rural homes (Langtau, 2003). Domesticated rice comprises of the species in the Poacease (true grass) family, *Oryza sativa* and

Oryza glaberrima. Rice is a complex carbohydrate, that is, it has more of starch and insoluble fibre which reduces the risk of bowel disorders and fight constipation. Complex carbohydrates are digested slowly, allowing the body to utilize the energy released over a longer period which is nutritionally efficient. It has low sodium content and contains useful quantities of protein, potassium, the B-vitamins, thiamine and niacin. Rice is a gluten free food, easily digested and wonderful for the very young and elderly (Oshaduma, 2010).

Food products from rice include; cooked rice, breakfast cereal, dessert rice flour and tuwo. Rice is also used in beer and in sake (saki), a Japanese fermented brew. Rice hull is used as fuel, fertilizer and insulation while the bran contain lipid of 14-17 percent oil. Straw from the leaves and stems is used as beddings for animal and for weaving roof, hats, basket and scandals. Because of its pure starch and free from allergens, it is the main component of face powders and infant formulas. Its low fibre content has led to an increase use of rice powder in polishing camera lenses and expensive jewelry (The Cambridge World rice history, 2011).

Rice processing is the post production aspect of the rice. It is the primary processing of paddy rice into end product for consumption. It involves all handling, conditioning and hydrothermal treatment given to paddy in order to convert it to edible product (NCRI, 2008). A survey conducted by National Cereal Research Institute (NCRI)(NCRI, 2008) revealed that Nigerian consumers show preference to quality rice. The Institute has developed improved technologies for processing rice such as:

i rice thresher: It dislodges rice seeds from the panicle and has the capacity of 3,000kg.

ii reciprocatory winnower: this equipment performs the function of cleaning the threshed rice seeds iii wet cleaners: It is used in separating lighter impurities that float on water from rice.

iv rice parboilers: It is used to heat-treat rice in order to properly gelatinize the starch in the kernels.

v rotary steam dryer: It dries about 1.5 tonnes of parboiled rice per day. It also has provision for condensation discharge and sets of screens that permits exit of moist air from the drying rice.

vi rice mills: It has a capacity to mill 3.5-4.0 tonnes of the paddy to 2.5-2.8 tonnes of paddy. It is made up of a frustum hopper, milling chamber, husk aspirator, spout and power unit.

vii Pneaumatic cleaner: This machine cleans milled rice to ensure that fine sand and bran that still accompanies the rice after the initial winnowing and wet cleaning operations are removed.

Studies have shown that three methods of rice milling can be identified in Nigeria; the hand pounding or traditional, the small mill processing and the large mill processing enterprises (Ezedinma and Atala, 2002). The hand pounding is still used by some village rice processors especially in northern Nigeria and the small rice mills are the most predominant of the three rice processing method. About 85 percent of Nigerian rice is processed through small mills (Akpokodje, Lancon and Erentein 2001).

Despite all government policies to boost rice production the gap still persists because of non availability of adequate facilities for processing of rice properly to meeting local demand both in quality and in quantity as well as international standard (Deanhanger, 2010). For Nigeria to attain the level of self sufficiency, food processing technology must command a greater interest.

Women have been found to be involved in agricultural production practices. Studies have shown that women are responsible for 100 percent of the work in food processing and 50 percent for marketing. Egunjobi (1991) reported that over 90 percent of economically active women engaged in one form of agriculture or the other.

Jiggins, Sananta and Olawoye 1997 also confirmed the high level of involvement of women in agriculture. In Minna (Alhaji, 2009) also reported that about 98 percent of rice processors are women and are actively involved in rice processing.

1.2 Statement of Problem

Rice is a strategic commodity in Nigeria economy. It contributes a significant proportion of the food requirements of the population yet the production capacity is below the national requirements. In order to meet the increasing demand, Nigeria has over the years resorted to importation of milled rice to bridge the gap between demand and supply (Akande, 2000) thereby placing Nigeria as the second largest importer of rice in the world. Studies conducted shows that most Nigerians has preference for imported rice owing to the fact that imported rice is of a higher quality, grade, better taste, polished, not broken and is free of debris (Bamidele, Abayomi and Esther 2010). The non competitiveness of local rice could be as a result of poor processing resulting in the final product with high percentage of broken rice, stone and debris (FAO, 2002).

The quality and quantity of rice is a major concern for the future of rice sector. In spite of this, the Nigerian government has not been intervening as expected so as to meeting increasing demand. Lack of adequate intervention into rice processing thereby abandoning this aspect into the hands of rural women without skill and appropriate technologies has led to low adoption of full innovations of improved rice processing giving rise to slow growth of this product compared to population.

The bid to accomplish the task of self sufficiency in food and improvement in the quality of life of rural area necessarily entails the shifting from the drudgery of age long use of traditional physical labor to the utilization of technological innovation (Adeniji, 2002). It is worthy of note that, rice processing is dominated by women using traditional method especially in cleaning and parboiling that is full of drudgery and lots of constraints as well as small mills with processing capacity of 150 kilogramme per hour resulting to not producing enough to meet domestic consumption and poor quality to meet market specification.

Quality and quantity of rice is a prime factor for self sufficiency in rice production however, small rice mills are the most predominant of the four rice milling machines. Presidential Rice Initiatives (2002) indicated that, there has been 3500 small/medium scale rice mills scattered all over Nigeria. Moreover, studies confirmed that about 85 percent of Nigerian rice is being processed through small mills (Akpokodje *et al.*, 2001). Based on this, the need to increase the level of adoption of improved technologies has become very necessary.

It is against this backdrop that this study sets out to determining the level of adoption of improved rice processing technologies such as rice thresher, wet cleaner, recipocatory winnower, rotary steam heater, pneaumatic cleaner and rice mills in Chanchaga and Bosso Local Government Areas.

Based on the aforementioned, the study seeks to answer the following research questions:

i. what are the personal and socio-economic characteristics of rice processors in Minna metropolis?

ii. what are the levels of awareness and sources of awareness of improved rice processing technologies by the processors?

iii. what is the level of adoption of the technologies?

iv what are the factors influencing the adoption of improved rice technologies in the study area?

v what are the constraints associated with the adoption of improved technologies in the study area?

1.2 Justification of the Study

Niger state has a total area of 8.6 million hectares out of which 7.0 million hectares are arable. Similarly, the State has a total irrigated land of 632,000 hectare out of which 220,000 hectare is used for rice production. The product at present comes from about 106,000 hectare spread across the state (Deanhanger, 2010). It has been observed by the recent studies that there is a wide gap between consumption and production of local rice. This is so because of non availabilities of adequate facilities for processing of rice properly to meet local and international standards (NCRI, 2008).

i This study is undertaken to provide data and analytical guideline that will help in sharpening policy focus including formulation, evaluation and implementation by relevant organs of government. It will aid in resuscitating our hitherto ailing Small and Medium Scale Enterprises (SMEs) of rice processing operation.

ii The findings will also serve as a handy guide in Extension teaching and learning by enabling the change agents address critical areas hampering the adoption of improved technologies.

iii The design of technologies will also take into account the peculiarities that will improve on the adoption process by practice.

vi Result of the study may be directed to other places where socio-economic and institutional factors are similar.

1.3 Hypotheses of the Study

The following null hypotheses (Ho) were to be subjected to empirical validation:

1. There is no significant relationship between the personal and socio-economic characteristics of women rice processor such as age, experience, labour availability, education, extension contact, income, access to credit and the rate of adoption of improved rice processing technologies
2. There is no significant difference between income realized by women before and after adoption of improved rice processing of technologies.

1.4 Objectives of the Study

The general objective of the study was to determine the level of adoption of improved rice processing technologies by women in the study area. The specific objectives were to:

i. describe socio-economic characteristics of the processors

ii. describe the level of awareness of the technologies by the women and identify the sources of awareness of improved rice processing technologies

iii. determine the level of adoption of the technologies

iv. determine the factors influencing adoption of improved rice processing technologies in the study area

v. identify constraints associated with adopting the technologies

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Rice Production Sector Analysis Worldwide

Rice is the second largest produced cereal in the World. At the beginning of the 1990s, annual production was at 350 million tons and by the end of the century it had reach 410 million tons. Production is geographically concentrated in Western and Eastern Asia. Asia is the biggest rice producer, accounting for 90 percent of the world's production and consumption of rice. China and India which accounted for more than the one third of global population supply over half of the world's rice. Brazil is the most important non- Asian rice producer, followed by United State of America, however Italy ranks first in Europe.

Today, rice is grown and harvested on every continent except Antartica, where conditions make its impossible. The majority of all rice produced comes from India, China, Japan, Indonesia, Thailand, Burma Bangladesh. Asian farmers still account for 92 percent of the world's total rice production. More than 550 million tons of rice is produced annually around the globe (RIMI, 2010).

In Nigeria rice is cultivable virtually spread over all the five ecological zones: rain fed upland, rain fed lowland or shallow swamp, irrigated system, deepwater or floating rice and tidal mangrove swamp. Despite this, the area cultivated to rice still appears small. In 2000, out of about 25 million hectares of land cultivated to various food crops, only about 6.37% was cultivated to rice. During this period, the average national yield was 1.47 tons per hectare. Significant improvement in rice production in Nigeria occurred in 1980 when output increased to 1million tons while area cultivated and yield rose to 550 thousand hectares and 1.98 tonnes per hectare respectively. Throughout the 1980s, rice output yield increased but in the 1990s, while rice output increased, the yield of rice declined, suggesting extensive rice cultivation (Akande 2000). Studies have shown that Nigeria is the largest rice producing country in West African but one of the largest importers in the World (Odoemena *et al.*, 2008). Rice production figure from 2004 put national rice production at 2.96 million tonnes of paddy cultivated on an area of 1,595,840 hectares. Yield estimate of 1.82 metric tonnes per hectare and total milled rice of 1,480,168 tonnes giving a milling recovery rate of 51 percent (FAO, 2004). While the total demand of milled rice is estimated to be 5.0 metric tonnes, only 3.0 metric tonnes of milled rice from local production, giving a deficit of 2.0 metric tonnes.

Rice production has been expanding at a rate of 6 percent, with 70 percent of the production increase due to land expansion and only 30 percent being attributed to an increase in productivity (Fagade, 2000; WARDA, 2007 and 2008; Okoruwa, Ogundele and Oyewusi, 2007). Niger state which is one of states in the North Central Zone of Nigeria is one the largest producer of rice in Nigeria, accounting for 47 percent of the total output in 2000. This is followed by Northwest (29 percent), Northeast (14 percent) Southeast (9 percent) and Southwest (4 percent). Kaduna state is the largest rice producing state in the country accounting for about 22 percent of the country's rice output, followed by Niger state (16 percent) (Ezedinma, 2005).

2.2 Rice Consumption Pattern in Nigeria

The average Nigerian consumes 24.8kg of rice per year representing 9 percent of annual calorie intake (IRRI, 2001). Due to its increasing contribution to the per capita calorie consumption of Nigerians, the demand for rice has been increasing at a much faster rate than domestic production and more than in any other African countries since mid 1970s (FAO, 2001). Further projection from the Food and Agriculture Organization (FAO) indicates rice consumption growth rates of 4.5 percent per annum through the 2000s, which will represent a 70 percent increase in total rice consumption by the end of the decade. Studies conducted shows that Most Nigerians have preference to imported rice owing to the fact that imported rice is of higher quality and grade, has better taste, polished, not broken and is free of debris as regard to the local Nigerian rice which is of low quality, less tasty, broken and usually accompanied by little stone and other debris like rice husk (Bamidele *et al.*, 2010). The demerit of Nigerians' preference and dependence on imported rice is more so as the share of the imported rice in Nigerian food market is far above that of domestically produced rice. Rice imports have affected the domestic production and marketing of Nigeria's local rice. This is due to decrease demand for local rice by Nigerians as opposed to the imported ones.

2.3 Rice Processing Survey in Nigeria

In Nigeria, rice processing technology superior to the one currently in use is available. Recent studies have shown that the gap between the existing level of technological knowledge and what is in use is not easily closed, hence has led to lower productivity.

The quality of local rice is one of the factors that led the elite to put pressure on government to import the commodity. The local rice is full of stones and debris. The scare that local rice causes kidney stones is very rampant. Sometimes local rice has off smell which to some is likeable, but it is offensive to those who buy foreign rice. The quality problem begins on the field where threshing is done in dug up holes on the ground and the rice is put into bags with sands, gravels and chaffs, a major concern for the future of the Nigerian rice sector (Langtau, 2003). While part of the issue relates to the biophysical properties of the varieties locally produced, the major problem is the appearance and the cleanliness of the rice delivered to the market.

While the milling technology has a great incidence on the technical performance, it is recognized that these attributes are greatly affected by the attention given to pre-milling and post-milling operations. These operations include winnowing paddy, drying, destoning, parboiling and eventually packing. Parboiling paddy is the most important processing operation besides milling. It consists of soaking paddy in hot or cold water in a drum, followed by a rapid exposure of the soaked paddy to steam and a gradual drying for at least one day. The purpose of the operation is to respond to consumer preferences while it also has a positive effect on the grain milling properties (high recovery ratio) and on its nutritious properties. In Nigeria, all paddy processed is parboiled. Rice farmers, millers and specialized operators providing the service to producers or traders can equally take care of parboiling operation. It is recognized that the quality of the parboiling operation has a great influence on the technical performance of milling and therefore on the quality of rice (Erentein, Akpokodje and Lancon, 2003).

2.4 Rice Milling in Nigeria

2.4.1 Type of rice mills

Rice milling in Nigeria is a ‘cottage industry’. No operational industrial mills are found. Still, substantial diversity exists within these relative small-scale operations. Rice mills are very diverse according to their milling capacity, ways of operation (combining milling and trading), range of processing operations performed and so forth. An attempt to build a typology through principal component and cluster analysis on selected variables has not been satisfactory due to the limited size of the sample (Lancon, Erentein, Akande, Titilola, Akpokodje and Ogundele 2003).

2.4.2 Milling capacity

The milling capacity is a common criteria used to classify workshops. The milling capacity in some sampled workshops in Niger state according to Lancon *et al.* (2003) varies from 50 kg of rice per hour in the smallest up to 5000 kg in the largest.

Milling capacity varies according to the type of equipment (engine power and type of huller), but the number of machines operating in the workshop is the major determinant. The largest workshops can have up to 4 or 6 engines working simultaneously.

Four main groups emerge :

i. 'Small size mill' - milling capacity below 150 kg of rice per hour.

ii. 'Medium size mill' - milling capacity between 150 and 300 kg of rice per hour.

iii. 'Big size mill' – milling capacity between 300 and 500 kg of rice per hour.

iv. 'Large size mill' – milling capacity between 500 and 5000 kg of rice per hour.

The most frequent type of mill encountered is the 'medium size' (150 to 300 kg/hr), which represents half of the sample, followed by the 'small size', the less frequent type of mills being the 'big size' and 'large size'. In terms of total processing capacity as expected the weight of the smallest mills is inferior to their weight in workshop sample. For instance, the small mill represents 26 percent of the sample while they offer only 8% of the total annual capacity. Conversely, the biggest type of mills represents only 8% of the sample and offers almost half of the total capacity. If we consider the actual volume of rice processed during the 2001-2002 campaign, the share of large mills declined to one third of the total production of the sample. This is due to a lower utilization of processing capacity for the bigger workshops than for the smaller ones..

The higher diversity of workshop sizes encountered in Niger state compared to Benue and Kaduna state can also be related to historical factors (Lancon *et al*., 2003). Traditional rice producing areas can be found in Niger state (like Gwari and Nupe) on the bases of which small scale processors targeting the local market have gradually developed. In addition, there is substantial production for the market in Niger state –including intensive and irrigated production systems that offers potential for larger size workshops. Nevertheless, rice-milling business is dominated by small size workshops with a processing capacity of 150 to 300 kg/hr – that is rather small-scale workshops that process less than 6 bags per hours. The largest mills, which have the largest capacity, do not hold a leading position on the market due to their inability to better utilize processing capacity.

2.4.3 Improved rice processing technologies in Niger State

i. Rice thresher

Threshing machine or simply called thresher was first invented by Scottish mechanical engineer named Andrew Meikle for use in agriculture. It was invented in 1784 for the separation of grains from stalks and husks. For thousands of years grain was separated by hand with flails and was laborious and time consuming.

Early threshing machines were hand-fed and horse powered. They were small by today's standards and were the size of piano. Later machines were steam-powered, driven by a portable engine or traction machine. Today, the threshing begins with a cylinder and a concave. The cylinder has sharp serrated bars and rotates at high speed so that the bars beat against the grain. The concave is curved to match the curve of the cylinder and serves to hold the grain as it is beaten. The beating releases the grain from the straws and chaff (Wikipedia, 2012).

ii NCRI adopted rice thresher:

It is made up of a trapezoidal hopper, threshing assembly is comprised of threshing drum that rotates within a concave made of steel rods. The drum is mainly composed of studs bolted to a flat bars that are arranged longitudinally at a distance of 10cm from one another and power is supplied by cool diesel engine to the cylindrical threshing drum.

iii. Reciprocatory winnower

Winnowing in its simplest form involves throwing the mixture into the air so that wind blows away the lighter chaff while the heavier grains fall back down for recovery. This machine performs the function of cleaning the threshed rice seeds. It is composed of a hopper, reciprocatory sieve assembly, chaff outlet, fine impurities, spout and seed outline. The sieve assembly is essentially made up of three metal screens of 15mm, 5mm and 2.5mm diameter hole size. they are arrange at an inclination angle of 45degree to the horizontal plane. A reciprocatory cam mechanism which is attached to this assembly obtains power from a 5hp single phase electric motor through pulley of the reciprocatory assembly is incorporated at the rear end of the reciprocatory system to expel chaffs and other lighter impurities

iii. Wet cleaners

These are cylindrical vessels having removable stirring and drain valves. Cleaning is done by introducing winnowed rice in batches into the vessel containing water. The stirrer is then turned vigorously at an average speed for two (2) minutes. The difference in specific gravity of the rice seed, chaff and other impurities that float on the water are removed with a plastic mesh and the stirring continues for about one (1) minute for more lighter materials to be removed before discharging the filled grains (NCRI, 2008)

iv. Rice parboilers

Rice parboilers are used to heat-treat rice in order to properly gelatinize the starch in the rice kernels. The steaming unit is rectangular in shape and made of 2.5mm thick galvanized sheet.

A cover is provided to prevent loss of steam while a false bottom is placed 15cm away from the base of the tank.

Rice from wet cleaner is introduced into the soaking/steaming tank containing water at 70-80 degree Celsius. The water is drain after eight (8) hours, then unloaded and tempered for 1-2 hours before feeding into the Rotary steam dryer.

v. Rotary steam dryer

This machine dries about 1.5 tons of parboiled rice per day. It is composed of the boiler placed over a bricks furnace and a rotary drying unit, which are inter-connected with 4mm diameter pipe. The rotary drying unit is a double wall insulated vessel having a jacket between the two walls for steam circulation. It also has provision for condensation discharge and sets of screens that permits exit of moist air from the drying rice. Power of rotation of the drum is obtained from an electric motor while firewood or gas is used as source of heat (NCRI, 2008).

Parboiled and tempered rice are fed int rotary drying unit per batch through a detachable hopper. The dryer is put on while water is heated in the boiler to raise steam. The drum with the content is allowed to rotate at 5 revolutions per minute unti the moisture content is reduced to about 30% to 18% before they are discharged.

vi. Rice mills: The milling chamber is comprised of a milling cylinder that is enclosed within a half cylindrical casing and sets of screen at the upper and lower sides. Power to the milling cylinder (rotating at 650-750rpm) and husk aspiration units are supplied by an electric motor through pulleys and belts.

The dried rice is put into the machine through the hopper while the shuttle is closed. The machine is then put on for 2-3 minutes before releasing the shutter slowing for the rice to dehusked in the first mill of each sets. Proper dehusking is ensured by adjusting the pressure device at the spout (NCRI, 2008)

vii Pneaumatic cleaner

This machines milled cleans rice to ensure that fine sand and bran that still accompanies the rice after the initial winnowing and wet cleaning operations are removed. The machine is somehow similar to the winnower except that the reciprocatory assembly of the pneaumatic cleaner is suspended with four flat spring iron bars while the one in the pneaumatic cleaner is suspended with spiral spring iron. Three sets of screens inclined at different angles 15 degree, 25 degree and 45 degree in different directions are incorporated in the reciprocatory unit. Also spouts for collection of cleaned rice, fine sand, dust and broken grains are provided within the same assembly. Power to the reciprocatory and blower units is provided by a 5hp single phase electric motor. Milled rice is introduced into the reciprocatory screen assembly through the hopper after switching on the machine. The shutter in the hopper is released to regulate the flow rate of the material into the screen assembly. The reciprocatory action of this unit which moves at 1.2m/sec results in separation of the fine sand, broken grains and whole grains which are collected through different spouts. The rice bran and other lighter impurities are separated by forced air stream at velocity of 7.5m/sec generated by the blower (NCRI, 2008).

2.5 Adoption of New Technologies

2.5.1 Basic conceptions and the theoretical foundations of adoption analysis;

Technologies play an important role in economic development of any country as it enhances accelerated growth. Adoption and diffusion of technology are the two interrelated concepts describing the decision to use and not to use in the spread of a given technology among economic units over a period of time (Oshaduma, 2010).

Technology is the applications of knowledge for practical purposes which are generally used to improve the condition of human and natural environment to carry out some other socio-economic activities. It is also considered as a complex blend of materials, processes and knowledge (Swanson, 1996). These processes are known as diffusion and adoption. Adoption is refers to as the decision to use a new technology by an individual or a group as the best course of action while diffusion is the process of information exchange, flow or spread of technology (object, idea or practice) for on original source to the end users (farmers).

A farmers decision about whether or not to adopt a recommended agricultural practice is recognized to occur over a period of time in stages rather than instantaneously. Most farmers go through a logical, problem-solving process known as adoption process. The adoption process is essential a decision making process (Ekong, 2003). According to Van den Ban & Hawkins (1996) consist of the five stages or steps that an individual goes through in adopting a technology namely:

i awareness stage: It starts when the individual first hears or finds out the existence of the technology. The client has little or no idea what is all about, how it works' how to use it and also the cost and benefit apart from probably knowing the name.

ii interest stage: In this stage, the individual develops interest and actively seeks further information such as how it works and about potentialities.

iii evaluation stage: This is when the individual weighs up the advantages and disadvantages of using it by going through a mental evaluation by asking self question such as 'is it worth it?' 'Can I do it' 'Do I have enough resources' 'Will it be beneficial to me and my family'. If the stages outweigh the disadvantages especially with regard to the capital outlay against what else might be done with the same amount of money and satisfaction they will get from these alternatives. The evaluation stage is terminated. Individual now make a decision to whether to reject or accept the technology.

iv Trial stage: This is a stage where the technology is put to test on a small portion of a farm to validate its workability on the farm practice. This is in order to answer question asked in the evaluation stage.

v adoption stage is the final stage when the individual apply the technology on a large scale and continue to use in preference to old methods. It should be noted that the technology could be rejected when the individual finds a better alternatives.

2.5.2 Factors affecting adoption of technologies

The rate at which a technology is adopted depends on certain factors. They are:

i. Relative advantage: It has been defined as the degree to which an innovation is superior to the one it is meant to supersede. This may be expressed either in economic or social terms (Ekong, 2003). For instance a rice processor that is given a parboiling machines used in carrying out the different stages; just as NCRI improved parboiling operation is done; soaking, steaming and drying could see this to be a greater advantage than manual parboiling. Although, each technology/innovation has its advantage(s), It is only when a person perceived this advantage(s) to be relative superior to the current, that is when it can be adopted.

ii Cost: A technology may be perceived as having an advantage over the current used practice but may not be adopted because of its cost. Generally, the higher the cost of technology, the more slowly its adoption. Cost may also be thought of in terms of what the adopter is supposed to give up and what he is to gain in adopting the technology. It may also be calculated in terms of time.

iii Complexity: this refers to the degree in which innovation is difficult to understand or use. Technology that is easier to understand or use tend to be more readily adopted than those that are complex.

iv Visibility: Technology varies in the extent which their result is easily seen.

v Divisibility: A technology that can be tried on a small scale will be adopted faster than those that cannot.

vi Compatibility: This refers to the extent to which a technology is consistent with the existing values, norms and past experiences of the adopter. A technology is easily adopted when it conforms to the existing cultural values and past experience of the adopters (Ekong, 2003).

Generally, for rapid technology uptake by farmers, technologies must be financially feasible, highly divisible, compatible with farmers' culture, result in increased production and entails minimum risk. A more comprehensive way is to examine the ten-way Test:

1. Availability: Is it available? Can it be gotten?
2. Affordability: Can the target audience afford it ? Is it within their pockets?
3. Acceptability: Is it accepted to the audience either socially or culturally?
4. Reliability: Is it reliable? Can it stand the test of time?
5. Adaptability: Is it adaptable to local conditions?
6. Durability: Is it durable enough? Will it last?
7. Maintainability: Can it be maintained by the audience without much problems?
8. Manufacturability: Can it be fabricated locally with the available raw materials and skills
9. Marketability: Does a good market exist for the widespread use?

10. Manageability: Is it manageable?

Answers to the above questions must be in the affirmative, if the new idea is to be adopted by farmers (Ilevbaoje, 2005).

2.5.3 Characteristics of innovation in terms of receiver's demand

Adopters are often considered the most rational people who are driven by situations necessitating changes in their system to meet some set goals which act as drive. However, they are conscious of the fact that some things have to be undertaken by them in this direction and are usually as forthcoming as possible. Some of the questions confronting them are to estimate what is required of them and whether or not they can cope (Adekoya and Tologbonse, 2005):

1. How much change is required? What demands are they to meet in terms of the knowledge, skill, perception, value adjustment etc? The extent of change required will align with the capacity of the adopter to take it in his/her stride and determine how much can be realized. A perpetual drive will be the farmer intends to actualize and the more the extension agent can put this in perspective, the more the farmer will be motivated.
2. What kind of change is demanded?

   This has to do with the physical activities that must be accomplished in taking steps to actualize the change. It deals with allocation of resources currently existing on the farm. This can be in the following;

   i) Substitution: It is usually based on comparism between relative advantages of new and old system. It involves a complete replacement of an old existing practice with a new one.

   ii) Alteration : It changes in part without replacing everything

iii) Addition: It is simply adding a new idea to the existing system which implies expansion.

iv) Reconstruction: This is a rearrangement of working place such as land use pattern, personnel etc.

v) Elimination: It is a complete removal of the practices found to be undesirable in the course of new light without taking on any new thing.

Once the farmer has clarity on this matter, it becomes easy to take the first step towards adoption as he is the fully prepared.

2.5.4 Non adoption of technologies

Lack of improved technologies (where there are non to use) or non-adoption (there are innovations but not adopted) of the technologies by the farmers has been given as the major reason for low productivity of small scale farmers. Roling and pretty (1996) opined that one major reason for non-adoption of technologies is because they are finished before farmers get to see them. Technologies that do not fit the farmers' condition or needs or that the farmers are unable to change are usually rejected.

Adhikarya (1996) also opined that non-adoption of recommended technologies often related to or caused by non-technological factors such as social, psychological factors, cultural and economic problems. Farmers were reported to reject available technologies not because they are conservatives or ignorant but because they rationally weigh the changes in incomes and risks associated with these given technologies under their natural and economic circumstances before they take any decisions.

An important component with regards to the non-adoption of technologies by farmers may be connected with communication processes. One of the reasons is that the farmer may be connected to the inability to make effective communication actually a two-way rather than one-way process in which the farmer is given opportunity to function as a sender (Fliegel, 1984). In actual fact all the actors (researchers, extension workers and farmers) in technology transfer are senders and receivers of messages in the S-M-C-R (Sender, Message, Channel, Receiver) communication process. Inability of a farmer to adopt may also be due to inadequate information feedback, which if present could have ensured technology transfer in the shortest possible time and also lay the ground work for redesign of inappropriate technology. Erinle (1994) posited that good research effort cannot make the desired impact if it is incapacitated by weak extension, poor institutional support and inadequate infrastructure.

2.5.5 Rate and level of adoption of improved technologies

Over the years, three methods determining adoption rate have been established in literature: the first is where crops are involved, the adoption rate is the ratio of the land area under the technology of interest to the total under the crop in reference multiplied by 100 percent (Ahmed and Sanders, 1991) and (Saka and Lawal, 2009). In another related studies, adoption rates are computed within the broader objective of assessing the economic impact of research generated technologies, and under the assumption that adoption follows some logistic trend or behavior. This assumption enables the researcher to project future adoption rate along a logistic curve, using observed innovations adopted divide by total land area or total number of adopters for some years of technology introduction (Phillip, Maiangwa and Phillip, 2000). The level of adoption on the other hand refers to the use by farmers of a number of improved practices used over total number of recommended practices multiply by 100 (Herdt and Capule, 1983).

The third method multiplies the ratio of adopting farmers to the total farmers in the sample by 100 percent Floyd, Harding, Paddle, Rasali, Subedi and Subedi (1999) and Adebayo, Saleh, Alabi and Durba (2010). This method is very popular mainly because of its simplicity.

2.6 Studies on Socio-economic Factor Influencing Adoption

Adoption of improved rice technologies are influenced either positively or negatively by certain factors; economic, political, sociological, socio-psychological, bio-physical and the perception of the farmers on the benefits and drawbacks of the practice. The growth and development of this sector of economy should be oriented in a manner which will foster, promote, encourage, and support change in the agricultural sectors Adeniji (2002).

Several studies on adoption have been carried out in Nigeria as well as other countries and have shown that there is a close relationship existing between the socio-economic characteristics and adoption of innovations. Reseachers such as Agwu (2004), Okunade, (2006), (Adeogun, Ajana, Ayinla, Yarhere and Adeogun, 2008), Saka and Lawal (2009), (Idrisa, Ogunbameru, and Amaza, 2010), Sulo, Koech, Chumo, and Chepng'eno (2012) confirmed this.

According to Adebayo *et al.* (2010) certain socio-economic characteristics such as ; age, household size, literacy level, occupation, mode of acquisition, capital incentive and marketability influence women request for and utilization of agriculture innovation. These characteristics were found to be significantly related to adoption. Zurek (2002) reported that the decision of farmers to adopt a farm practice was influenced by number of different factors that include the biophysical conditions of the farm, certain characteristics of the farmer and household, institutional settings under which the farm operates and the perception of the farmers on the benefits and drawbacks of the practice.

Sulo *et al.* (2012) recorded socio-economic characteristics influencing adoption of technologies to be positive and very significant, Idrisa *et al.* (2010) recorded socio-economic characteristic such as farm size, hired labor etc to be significant but negatively related to adoption.

In another related study, Fashola, Oladele, Alabi, Tologbonse and Wakatsuk (2007) found out that membership of association, level of education were important contributors to adoption decision of farmers. However it also showed the frequency of extension contact to be significantly related to adoption of innovation. More so, similar studies by Omonona, Oni and Uwagboe, 2005 recorded that sex, age, access to extension agents were positive and significantly related.

2.7 Improved Rice Processing by National Cereal Institute (NCRI).

It is the primary processing of paddy rice into end product for consumption. It involves all handling, conditioning and hydrothermal treatment given to paddy rice in order to convert it to edible product.Improved rice processing may be grouped into: cleaning, parboiling and milling (NCRI, 2008).

2.7.1 Cleaning of paddy rice

Cleaning of the received bulk paddy is undertaken before the parboiling operation. This is the process whereby the foreign matters or impurities, straws, seed of other crops, unfilled grains, damage grains are removed from the paddy to leave a cleaned paddy for processing operations. Paddy rice is cleaned after threshing to remove most of the foreign matters and after storage before parboiling operation commence.

This can be done manually or mechanically but the most important thing is to get rid of foreign particles to improve the quality of the paddy for parboiling. Floating technique is used as a pre-cleaning system to remove chaff and minute impurities. Water is poured into a cleaned tank and paddy rice introduced into it. It is then stirred several times, about 3-4 times to allow the floating of the particles. The lighter foreign matters will float while the heavier ones will settle at the bottom. It is worthy to note that if these impurities are soaked with paddy rice, they will absorb water through diffusion and decompose or ferment thereby impacting bad flavor and color to the milled rice.

2.7.2 Rice parboiling

Rice parboiling is the critical rice processing operation as far as the quality of rice is concern. The method varies from one location to another, in terms of the equipment and sophistication employed. Parboiling describes the different processes that paddy is subjected to before getting the final product (milled rice).

In Nigeria, parboiling is done mostly by women using their simple household items such as cooking pots, wood fibres, baskets, oil drums, large clay pots which they parboiled between a bag to three bags per day depending on the available resources.

Parboiling is carried out for a number of reasons:

To improve the nutritional status of the product

a) To reduce breakages during milling
b) To change the cooking characteristics
c) To impact different eating characteristic

However, irrespective of the method used, it is often carried out in three different stages; just as NCRI improved operation is done

i) Steeping (soaking)
ii) Steaming

iii) Drying

i. Steeping or soaking

Paddy rice is soaked in warm or hot water for between 5-6 hours or overnight to enable the paddy attains a moisture content of about 30 percent. The ideal temperature for soaking is between 70℃ -75℃ though it depends on the variety of paddy. In cold water practiced by women, soaking takes 2-3 days at ambient temperature. It causes fermentation to take place thereby giving milled rice unpleasant odour. However, paddy is soaked for quick and uniform water absorption.

ii Steaming (heating)

The pressurized steam is passed through perforated pipes laid inside the tank containing the soaked paddy rice for 100℃. It is important to know that steaming should be done as fast as possible, between 15-55 minutes. This will give the milled rice normal colour but if the steaming is extended, it darkens the colour of the milled rice. Completion of steaming is noticed when the grain expands, kernel softened and the hulls lemma and palea start to separate (splits).

However, steaming is done to cook the rice starch to a level it will swell irreversibly and lose its crystal nature, and optimum steaming is observed when the grain hulls start to crack.

iii Drying

Drying of parboiled paddy rice is different from drying of rough paddy rice since it has high moisture content. Steamed paddy rice is dried either by sun, shade or mechanical dryer to a safe and protective moisture content of 12-14 percent before milling. Drying usually requires heat to evaporate the moisture from the grain and moving air to carry away the evaporate moisture.

Also, the rate of drying is influenced by: the variety of rice, air temperature, relative humidity of the surrounding atmosphere, the grain temperature, the grain initial moisture content, the mass of air pass through the grain, the drying method employed and the efficiency of the equipment.

2.7.2.1 **Drying methods**

i. Sun drying:

Sun drying is the most common method and provides little control over the rate of drying. However, steamed paddy is spread on tarpaulin or concrete slab to reduce moisture. It is either spread in thin layer or thick layer depending on the weather then turned or raked at intervals. Continous and rapid drying of paddy will create stress in the rice kernel which will eventually crack and will break during milling.

ii. Mechanical drying:

This is a mechanical method of drying paddy rice. It has a holding capacity for, blower for air and heating of air is provided also.

There are different capacities and prototypes. In Nigeria little or no mechanical drier is used in rice drying, this is mainly as the result of the following factors:

(a) Availability of sun

(b) High cost of fuel

(c) Small farmers producing a small volume of paddy can easily use sun drying

(d) Lack of capital for investing in artificial dryers

(e) Lack of know-how about the drying technology.

iii Tempering

This is a system in paddy rice drying whereby after removing parboiled paddy from drying, the dried paddy is allowed to cool before milling i.e it is kept in the shade to allow the grain moisture content to equalize. Immediate milling of paddy rice after removing from the sun should be avoided.

2.7.3 Rice milling

Rice milling is the only rice processing operation that is mechanized to appreciable extent in this country. It is an important aspect of rice production because harvested paddy eventually end up as milled rice (parboiled milled or raw milled) ready for consumption.

Milling therefore is the partial or wholly removal of husk, bran and germ to produce a clean rice kernel. It is a crucial step in post production of rice. The basic objective of a rice milling system (particularly NCRI mill) is to remove the husk and bran layers, and produce an edible white kernel that is sufficiently milled and free of impurities. Depending on the requirement of the consumer or customer, the rice should have a minimum of broken kernels.

Most rice varieties are composed of roughly 20 percent rice hull, 11 percent bran layers and 69 percent starchy endosperm, also referred to as the total milled rice. Total milled rice contains whole grains or head rice and broken.

The by-products in rice milling are rice hull, rice germ and bran layers and fine brokens. However, milling involves: Dehusking and polishing

A rice milling system can be a simple one or two step process, or a multi stage process. In a one step milling process, husk and bran removal are done in one pass and milled or white rice is produced directly out of paddy but in two step process, removing husk and removing bran are done separately, and brown rice is produced as an intermediate product. In multi stage milling rice will undergo a number of different processing steps (NCRI, 2008).

2.8 Theoretical Framework of the Study

2.8.1 The adoption – diffusion theory

Adoption and diffusion studies have addressed critical issues relating to innovation or production technologies over time. However differences exist in the course of diffusion among farmers which require some attention in order to acquire achieve meaningful adoption. Also, there are some areas or circumstances related to agricultural innovation which conscientious decisions are taken in order to ensure successful adoption. Adoption represents a full-scale integration of recommended practices or innovation into the on-going farm operations. It is referred to as a process because adoption of improved technologies is not a simple unit act. Adoption therefore consists of series of actions which are preceded by thoughts. Adoption manifest in increases in food production and farm management practices. The totality of thoughts, which take place between the time the farmers first hears of the innovation and the time he eventually makes his decision to integrate the innovation in his farm represents adoption process (Ugwu and Agbo, 1999).

Diffusion is a sociological process by which an innovation spreads over time among intended users in a society. According to Ekong (1988), an innovation is an idea perceived by individual as novel to his farming system which is capable of improving the standard of living. Diffusion is secondary to concentrated effort of an extension worker in influencing optimum leaders of a social system to accept innovation as worthwhile in improving life of a given population. It involves the use of appropriate channels such as local leaders, religious organization, mass media (print and electric media), extension agents, friends and neigbours (Jibowo, 1992).

The following conceptual model serves as the framework of this study:

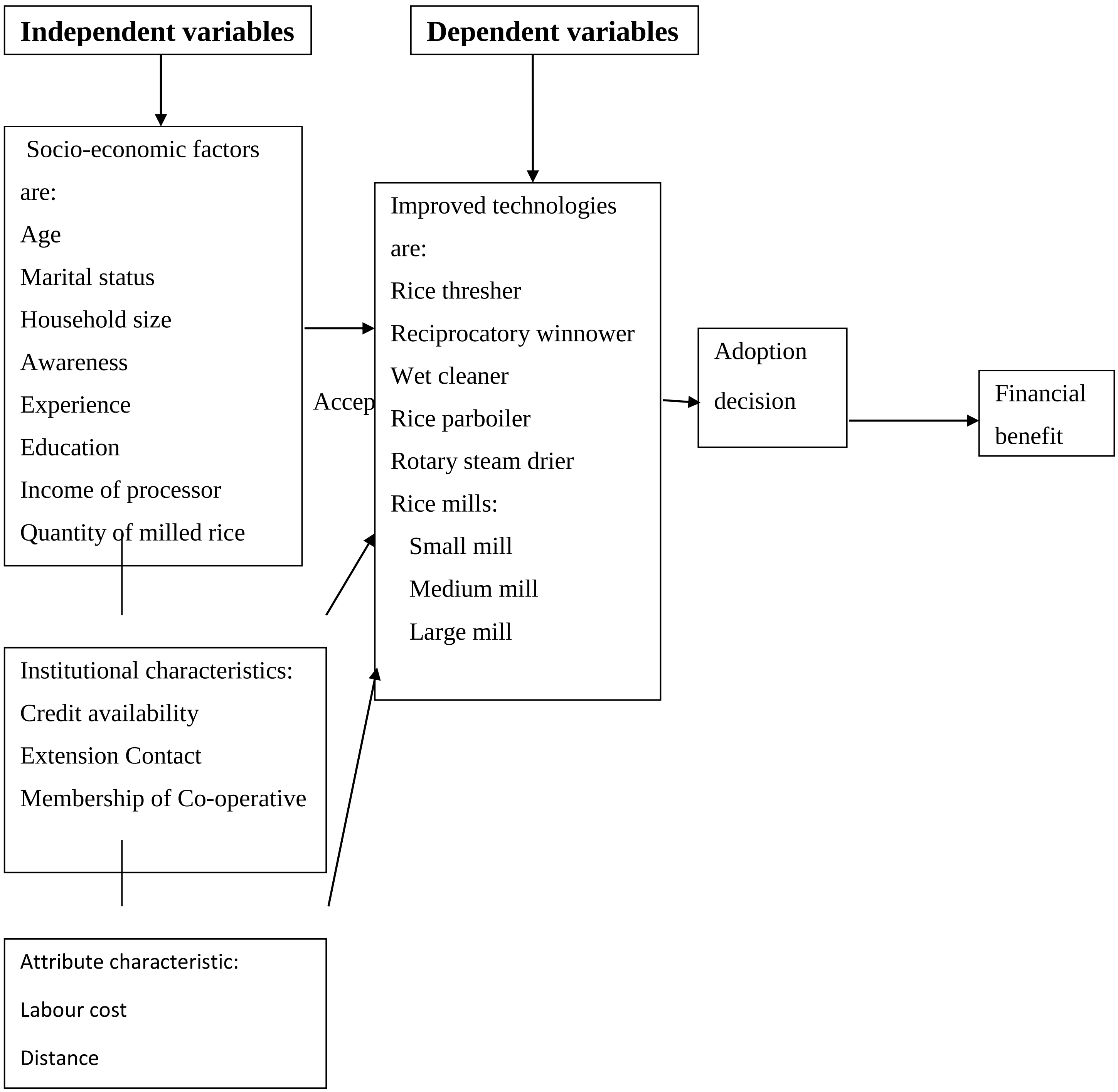

Figure 2.1 Conceptual framework of the study indicating dependent and independent variables

Source: Abebe (2007) (Adjusted and adopted for the study).

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

This chapter presents the area of study, methods of data collection, sampling technique and sample size, method of data analyses and measurement of variables.

3.1 The Study Area

This study was conducted in Chanchaga and Bosso Local Government Areas of Niger State which are under Minna administrative zone. Niger State is one of the 36 States of Nigeria created out of the defunct North Western State on the 3rd February, 1976 and situated in Southern Guinea Savanna ecological zone. It lies between latitude 08°- 10°N and longitude 03°- 08°E of the prime meridian (Wikipedia, 2008). The state share borders with Benin Republic to the west, Kwara and Kogi States to the south, Abuja the Federal capital Territory and Kaduna State to the east and Kebbi and Zamfara State to the north. The state comprises of 25 Local Government Areas grouped into three administrative zones A, B, C with each zone having 8, 9 and 8 Local Government Area respectively. Niger State is one of the largest States in Nigeria covering about 86,000km^2 or (8.6 million hectares) representing about 9.3% of total land area of the country (Niger State Wikipedia, 2006). The current population is estimated at 4,082,558 (Wikipedia, 2008). The easily identifiable major ethnic groups are the Nupes, Hausa and Gbagyi. The people of Niger State are predominantly farmers.

3.1.1 Climate and vegetation

The State is situated in the middle belt zone of the country and it possesses fertile soil for agricultural purposes. It is characterized by two main seasons which are the wet seasons and the dry season. The annual rainfall varies from 1100mm-1600mm with average temperature ranging from 23˚C to 37˚C and daylight duration is averagely 8.5 hours and it has a relative humility of 40 percent (NSADP, 1994). The dry season commences in October and stops in March, while the rainy season commences in April and stops in September. The most prominent soil types are the ferrogenous tropical soils which are suitable for mechanization as well as intensive cultivation of root, tuber crops and cereal such as rice, maize, millet, sorghum, etc. Also grown are legumes, vegetables, fruits, seeds and nuts as well as industrial tree crops (Eluwa, 2010). Rearing of livestock like sheep, cattle, goats, poultry, fishery and aquaculture are also practiced.

3.2 Sampling Techniques and Sample size

Eight processing locations were sampled based on the preponderance of rice processors. The sampling frame consisted of 240 processors from the eight processing locations in Chanchaga and Bosso Local Government Areas. Respondents were sampled purposively and proportionately from each processing locations namely: Kpakungu (18), Gidan Mangoro (15), Dutse Kura (15), Tunga (12), Maikunkele (17), Bosso (17), Maitumbi (14) and Chanchaga (12) to give a sample size of 120 rice processors.

3.3 Methods of Data Collection

Primary data were obtained by the use of structured questionnaires and personal interview schedules. The questionnaires were administered to the rice processors under study area. Data collected covered three spheres, namely: (a) socio-economic and institutional variable, (b) technology-specific variables and (c) psychological factors such as social participation, market perception, and opinion. In specific terms, the following data were elicited from the respondents:

i socio-economic, institutional and personal attributes of the processors such as age marital status, experience in the business, labour cost, level of education,

extension contact, household size, distance, personal income, membership of cooperative, etc.

ii the level of awareness of the technologies by the processor and sources of awareness of improved rice processing technologies

iii the level of adoption of improved rice processing technologies

iv factors influencing adoption of improved rice processing v constraints associated with the adoption of the improved rice technologies communicated to the farmers.

Information were obtained from textbooks, newspaper publications, articles, published journals, past projects, the internet, Agricultural Development Programme (ADP), and other unpublished material to buttress this study.

3.4 Method of Data Analysis

Data were coded according to objective of the study and analyzed using Statistical Package for Social Sciences (SPSS) version 15. The analytical tools used were descriptive statistics a probit model and Z-test.

Descriptive statistics such as means, tables, frequency distributions, standard deviations etc. were used to achieve objectives 1, 2, 3 and 5. A probit model was used to analyze factors influencing adoption of the improved rice processing technologies in the study area so as to achieve objective 4.

In technology adoption studies, limited dependent variable models such as Logit, Probit, and Tobit continue to have extensive applications in obtaining information from the non normal distribution of such data (Polson and Spencer, 1991).The Ordinary Least Squares regression is inappropriate when the dependent variable is discontinuous (Pannell *et al.*, 2006). Logit and Probit models are appropriate when the dependent variable is discrete, usually taking two values, 0 or 1. These models are useful if the question is whether to adopt or not, but are not appropriate when it is important to measure the intensity of adoption of a technology. So for this study, probit model was used to achieve objective iv, that is, factors influencing adoption of improved rice processing technologies.

3.5 Empirical Model Specification

3.5.1 The probit regression model

$Y = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + b_{10}x_{10} + b_{11}x_{11} + b_{12}x_{12} + e$

…………………………………………………Equation 1

Empirical literature has generally attempted to analyze observed adoption patterns by focusing on a set of factors i) socio-economic characteristics of adopters, ii) institutional factors, and iii) technology characteristics or attributes of innovations as perceived by farmers.

According to Pannell, Marshall, Barr, Curtis, Vanclay and Wilkinson (2006), when adoption is viewed as a social process, it becomes clear that one should expect adoption behavior to be influenced by the personality of the decision maker, their social networks, personal circumstances and family situation. It seems that in the empirical literature, every measureable characteristic of farms and farmers has been found to be statistically related to some measure of adoption of some innovation.

Probit regression model was used to establish the relationship between the likelihood to adopt improved rice processing technologies and various factors influencing it. This approach is similar to that used by Fufa and Hassan (2006) and (Alene and Manyong, 2007). An adoption decision is a dichotomous choice where a farmer adopts a technology if there is a positive marginal net benefit compared to that of not adopting it.

The probit regression model is specified as follows:

$Y = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + b_{10}x_{10} + b_{11}x_{11} + b_{12}x_{12} + e$

where:

Y = Adoption of improved rice processing technologies (Likelihood of adoption and dummy variable 1 for adoption and 0 for non adoption)

x_1 = Age of respondent (Years)

x_2 = Marital status (Single = 0, Married = 1, Divorced = 2, Widowed = 3)

x_3 = Experience in rice processing (Number of years)

x_4 = Labour cost (₦)

x_5 = Education of the processor (Number of years)

x_6 = Awareness of the technologies (Ratio of technologies aware of)

x_7 = Extension contact (Number of times of contact)

x_8 = Household size (Number of persons)

x_9 = Membership of cooperative (Dummy; member = 1, non-member = 0)

x_{10} = Distance of the processing facility to resident (Km)

x_{11} = Income of processor (₦)

x_{12} = Quantity of paddy rice milled per month (Kg)

e = Error term

b_o = Constant

$b_1 - b_{12}$ = Regression coefficients

3.5.2 The Z-test statistics

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{SD_{\bar{X}}} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$ ………………………………………………………………………..Equation 2

Where:

$\bar{x}_1$ = mean of income before adopting improved rice processing technologies.

$\bar{x}_2$ = mean of income after adopting improved rice processing technologies.

n_1 = number of processors before adopting improved rice processing technologies.

n_2 = number of processors after adopting improved rice processing technologies.

s_1^2 = standard error of income before adopting improved rice processing technologies.

s_2^2 = standard error of income after adopting improved rice processing technologies.

$SD_{\bar{x}}$ = standard deviations of the means.

Z = Z-test

3.5.3 Measurement of variables

ADOPTION: Adoption is a decision to make full use of an innovation or technology as the best course of available action (Rogers, 1996). Eight technologies were presented to respondents to indicate the one currently in use. Adopted technology = 1 while non-adopted technology = 0

AGE: Age refers to the number years of the respondents. Respondents indicated their ages in years and were later categorized into groups.

MARITAL STATUS: Respondents indicated their marital status from the list of statuses provided.

EXPERIENCE IN RICE PROCESSING: This is the number of years in rice processing. The respondents indicated the number of years they have been processing rice.

LABOUR COST: Respondents indicated the type of labour and the amount used in processing. It was measured in naira.

EDUCATIONAL LEVEL: This refers to the number of years spent in koranic, adult education, primary, secondary and post secondary schools. Respondents indicated the number of years spent in formal education. It was measured based on the years of schooling.

AWARENESS: The respondents were presented with a list of improved rice processing technologies and they indicated technologies that they have knowledge of.

CONTACT WITH EXTENSION AGENT: This was measured by indicating the number of contact times with the extension agent with the respondents per month

INCOME OF THE PROCESSORS: Income is the amount of money in Naira that accrued to the respondents from the sale of milled rice. Respondents indicated the income from the sale of rice, measured in naira (₦).

HOUSEHOLD SIZE: The total number of people in respondents' household. Respondents indicated the number of people in their houses.

MEMBER OF COOPERATIVE: A cooperative is a social organization whereby members have similar goal and objectives. Respondents indicated if they belong to any cooperative society. Member = 1 while non-member = 0

LOCATION OF PROCESSING FACILITY: This refers to the nearness or proximity of processing facilities to processors. Respondents indicated the proximity to their processing facilities in Kilometres (Km).

QUANTITY OF RICE MILLED PER MONTH: This was measured in 50kg/bag

3.6 Test of Hypotheses

The hypotheses for this study were tested using the following analytical tools:

Hypothesis 1 was tested using probit regression

There is no significant relationship between adoption and the personal and socio-economic characteristics of the women processors.

Hypothesis 2 was tested using student Z-test

There is no significant difference between income realized by women processors before and after adopting the technologies.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Socio-economic Characteristics of Rice Processors

The socio-economic characteristics of the respondents such as age, gender, marital status, religion, educational level, household size, years of experience, major occupation etc. were examined in this section. An adequate knowledge of the personal and socio-economic characteristics will provide insight into their adoption behaviour.

4.1.1 Age

Age is said to be a primary latent characteristic in adoption decision. It is an important variable that determines the nature of activities that can be undertaken by an individual most especially women. While younger and more energetic women may be involved in strenuous farm based activities, older women are most likely given to be involved in less strenuous activities. Age of respondent was analyzed using frequency and percentage.

The result in Table 4.1 shows that most of the respondents (88.3 percent) were at their productive age (21-50) while 10.9 percent represents the older respondents (51-60) and 0.8 for the younger respondents (<21). The mean age of respondent was 37 years. This implies that rice processing is dominated by young, middle age, active and mentally alert processors that are receptive to new innovations. This is in agreement with, Arellanes and Lee (2003), Agwu (2004), Nwaru (2004) and Adeogun *et al.* (2008) and Enitan (2010) who found out that adoption is associated with youthful and active age when women can make vital impact in agricultural production processing and technological development generally.

Table 4.1 Distribution of Respondents According to Age

Age interval (Years)	Frequency	Percentage	Mean
< 21	1	0.8	

21-30	26	21.7	
31-40	40	33.3	
41-50	40	33.3	
51-60	11	9.2	
>60	2	1.7	37
Total	120	100.0	

Source: Field survey, 2012

4.1.2 Marital status

Marriage is an important attribute in African culture. It connotes respect and responsibility to demand in terms of income to meet the family needs as well as increase in family labor. It was analyzed using frequency and percentage.

Result in Table 4.2 indicated that 90.8 percent of the respondents (109) were married which showed the highest proportion from the analysis. Single and widowed were 3.3 percent of the respondents (4) respectively while Divorced were only 2.5 percent of respondents (3). Ekong (2000), Nwachukwu and Jibowu (2000), Okoye *et al.* (2008) and Enitan (2010) in similar studies found out that majority of married women were into agricultural activities.

Table 4.2 Distribution of Respondents According to Marital Status

Marital status	Frequency	Percentage
Single	4	3.3
Married	109	90.8
Divorced	3	2.5
Widowed	4	3.3
Total	120	100.0

Source: Field survey, 2012

4.1.3 Household size

Household according to Ekong (2003) refers to all persons occupying the same house and eating from the same pot. These include relatives and lodgers. The size of a household in this study also refers to the number of people living with the respondent at the time of interview. It was analyzed using frequency and percentage. Household size is an important variable that can determine the total food requirement and overall food security Enitan (2010). It can hinder the adoption of technologies in areas where farmers are very poor and the family resources are used for other commitment with little left purchasing an innovation and on the other hand, can be an incentive for adoption of new technologies as more agricultural output is required to meet family food consumption need.

The result from Table 4.3 reveals that 47.5 percent of the respondents had the highest household size ranging from 16-20, 30 percent of the respondents had 11-15 household size, 20 percent had a household size of 6-10, 1.7 percent had 1-5 household size. The mean household size from the analysis stood at 15. This implies that the respondents can use their household for substituting labor cost hence paying less in terms of labor. This result is contrary to Odebode and Mungong (2001), Bammeke (2003) and Enitan (2010) who found out an average of 6-10 people as the household size.

Table 4.3 Distribution of Respondents According to Household Size

Range	Frequency	Percentage	Mean
1-5	2	1.7	
6-10	24	20.0	
11-15	36	30.0	
16-20	57	47.5	
>21	1	0.8	15
Total	120	100.0	

Source: Field survey, 2012

4.1.4 Education

It is generally accepted that education is the bedrock of any society. Education is an institution that promotes social, economic and technological change. It creates room for the acquisition of knowledge and skill thereby paving ways for modification of culture, norms and value. It was analyzed using frequency and percentages.

The levels of education of respondents determine the level of decision making on productivity. Ideologically, the higher the level of education, the higher the adoption rate of innovation and vice versa.

The result in Table 4.5 reveals adult education having a percentage of 34.2, primary education had 25.8 percent, secondary education had 20.8 percent, quranic education had 14.2 percent, non-formal had 4.2 percent and tertiary took the least with 0.8 percent. This implies that civilization is gradually influencing the culture of the society whereby respondents in the study area are enrolled in schools. This is contrary to Fakoya *et al.* (2001) who reported the low education attainment among women processor which had the tendency of low level of technology adoption

Table 4.4 Distribution of Respondents According to Level of Education

Education status	Frequency	Percentage
Tertiary	1	0.8
Secondary	25	20.8
Primary	31	25.8
Adult education	41	34.2
Quranic education	17	14.2
Non formal	5	4.2
Total	120	100.0

Source: Field survey, 2012.

4.1.5 Occupation

Occupation is a job or a profession. It is an economic activity one does to keep him/her busy or occupied as well as earning a living. It was analyzed using frequency and percentage. The findings indicate major occupation as trading with a higher percentage of 82.5 percent to farming with 17.5 percent. This implies that the respondents engaged in selling of processed rice as well as other commodities. This is in agreement with, Adisa and Adekunle (2007) who found out trading was the most common non-farm activities in a similar study but contrary to Okunade (2006) and Okoye, Okoye, Dimelu, Agbaeze, Okoroafor and Amaefula, 2008 who recorded the farming as major occupation.

Table 4.5 Distribution of Respondents According to Occupation

Occupation	Frequency	Percentage
Farming	21	17.5
Trading	99	82.5
Total	120	100.0

Source: Field survey, 2012

4.1.6 Years of experience

Experience refers to active involvement in an activity or exposure to something over a period of time. The number of years farmers have spent in farming will increase the experimental base and this will assist in making adoption decision Adeniji (2002). It was analyzed using frequency and mean.

The findings in Table 4.7 indicate that respondents with 11-20 years of experience had the highest frequency of 62 representing 51.7 percent. Respondents with 21-30 years of experience had a frequency of 26 representing 21.7 percent. More so, respondents with 1-10 had a frequency of 23 representing 19.2 percent and respondents with the least frequency of 2 represented 1.7 percent. The mean number of years of experience was 20.5. This implies that respondents with longer number of years are likely to adopt in lieu of the fact that they have adequate knowledge as regards the intrigues of the business thereby being able to make sound decision as well as managing risk. This is in agreement with Adeniji (2002), Agwu (2004) and Okunade (2006) who reported that farmers with long period of farming experience would be conversant with constraints to increase productivity and this could increase their level of acceptance of new ideas as means of overcoming their productive constraints.

Table 4.6 Distribution of Respondents According to Years of Experience

Ranges (Years)	Frequency	Percentage	Mean
1-10	23	19.2	
11-20	62	51.7	
21-30	26	21.7	
31-40	7	5.8	
>40	2	1.7	20.5
Total	120	100.0	

Source: Field survey, 2012.

4.2 The Level of Awareness

The level of awareness of respondents about improved rice processing technologies in the study area were examined using frequency and percentage. The responses of the respondents were captured and the result were summarized as presented in Table 4.8

Awareness is a state of having knowledge of the existence of a particular technology for the first time. It is the first stage in adoption processes. The individual lacks necessary details concerning the innovation in terms of actual content, the way it works, its cost and affordability with available resources and its benefits.

The result in Table 4.7 reveals large, medium, small mills, Parboiler and Cleaner to have high awareness levels of 99.2 percent, 85.8 percent and 75.0 percent respectively while thresher, dryer and winnower had low awareness levels of 54.2, 50.0 and 29.2 percentage respectively. This implies that technologies with high awareness percentage are likely to be adopted since awareness stimulates adoption.

Table 4.7 Distribution of Respondents According to their level of Awareness of Improved Rice Processing Technologies

	Aware		Not aware	
Improved Technologies	Frequency	Percentage	Frequency	Percentage
Small mill	119	99.2	1	0.8
Medium mill	119	99.2	1	0.8
Large mill	119	99.2	1	0.8
Winnower	35	29.2	85	70.8
Parboiler	103	85.8	17	14.2

Thresher	65	54.2	55	45.8
Dryer	60	50.0	60	50.0
Cleaner	90	75.0	30	25.0

Source: Field survey, 2012.

4.3 The Sources of Awareness

The analysis from Table 4.8 shows that extension agents, farmer groups and friends had a greater percentage of respondents' sources of awareness of 93.3 percent, 85.8 percent, and 72.5 percent respectively. The less frequent sources employed by respondents are radio (0.8 percent), Television (4.2 percent), Research institute (2.5 percent) and village head (0.0 percent). The implication is that extension agents, farmers' group and friends are the closest to respondents where information are gotten. Respondents may rarely have the time to access information on radio and television.

Table 4.8 Distribution of Respondents According to Sources of Awareness

	used		Not used	
Sources	Frequency	Percentage	Frequency	Percentage
Extension agent	118	98.3	2	1.7
Radio	1	0.8	119	99.2

Television	5	4.2	115	95.8
Village head	0	0.0	120	100.0
Farmer groups	103	85.8	17	14.2
Research institute	3	2.5	117	97.5
Friends	87	72.5	33	27.5

Source: Field survey, 2012.

4.4 Level of Adoption of Improved Rice Processing Technologies

Adoption is the final stage of the adoption process. This is a stage where an individual makes a mental and practical evaluation to make the final decision as whether to use or eject an innovation Van den Ban and Hawkins (1996). It was analyzed using frequency and percentage.

Adoption rate is the relative number of innovation/technology that is put to use. It is multiplying the ratio of adopting farmers to the total number of farmers in the sample by 100 percent. It is being influence by factors such as the relative advantage (the degree of superiority both in economic and social term of innovation over the existing one), cost, complexity, visibility, divisibility and compatibility (Ekong, 2003).

Result in Table 4.9 shows that small mill had a very high adoption percentage of 100.0, parboiler had 84.2 percent, cleaner with 53.3 percent. Winnower, thresher, dryer, medium mill and large mill had a very poor adoption percentages of 0.0, 0.8, 0.0, 0.0 and 0.0 respectively. This implies that Cleaning, parboiling and milling rice has been adopted compare to others.

The levels of awareness by respondents affect the adoption of technology positively and negatively. The high adoption rate of small mills, parboiler and cleaner was as a result of the high level of awareness of these technologies while the low level of awareness of other technologies affected their adoption negatively as established in Table 4.10

Table 4.9 Distribution of Respondents According to the Level of Adoption of Improved Rice Processing Technologies

	Adopted		Not adopted	
Technologies	Frequency	Percentage	Frequency	Percentage
Small mill	120	100.0	0	0.0
Medium mill	0	0.0	120	100.0
Large mill	0	0.0	120	100.0

Winnower	0	0.0	120	100.0
Parboiler	101	84.2	19	15.8
Thresher	0	0.0	120	100.0
Dryer	1	0.8	119	99.2
Cleaner	64	53.3	56	46.7

Source: Field survey, 2012.

4.5 Factors Influencing Adoption of Improved Rice Processing Technologies

The factors influencing adoption of improved rice processing technologies were determined using a probit regression model. The analysis in Table 4.11 shows that the age (0.016) of the respondents was positive and significant at 1 percent level reveals that age significantly affected the probability of adoption of improved rice processing technologies. This implies that as the age of respondent increases, the probability to adopt also increases. That is, an older respondent is likely to adopt more than a younger one. This is contrary to *a prior* expectation but is in agreement with the findings of Adeniji (2002) who also found that adoption of improved technologies was higher among older farmers than the younger ones but against other related studies such as Peter and David (2003), Adeogun *et al*.(2008), Saka and Lawal (2009), Adeniyi and Valerie (2010) and Sulo *et al.*(2012)

The years of experience of the respondents with (-0.010) was indirectly related to adoption and significant at 5 percent level. This suggests that the more experience a respondent is, the less the adoption would be. This could be as a result of exposure and knowing the intricacies involve over years and therefore does not see the need of adopting innovations. This supports what Adeogun *et al.* (2008) said in a similar research.

The coefficient of education (0.041) was positively related to adoption and strongly significant at 1 percent. This implies that education has a direct influence on adoption of improved rice processing technologies. Therefore, the more the years of education, the more the likelihood to adopt.

In the same vein, labor cost for improved rice processing technologies (0.001) which was positively and significant at 5 percent level indicates that labor cost significantly affects adoption of improved rice processing technologies. This however, had a direct relationship with adoption. It implies that respondents spent more money to hire labor, hence the possibilities to adopt will be high so as to curtail cost on hired labor. This is against the finding of Idrisa *et al.* (2010) who found out that hired labor in farming activities could also encourage the diversion of rural labor force into generating non-farm income and thereby diversifying sources of income for the rural dwellers but in line with the findings of Bamire and Manyong (2003).

Similarly, the coefficient of awareness (0.152) was positively related to adoption and highly significant at 1 percent level. This means that as respondents are exposed to innovations and stimulated, there is also the likelihood to adopt.

Quantity of processed rice per month (0.004) was positive and significant at 1 percent with income. This means that quantity of what the women processed per month has a direct effect with income of the women who used improved rice processing technologies.

The observation from the analysis indicates extension contact (-0.281) to be negatively related to adoption of improved rice processing technologies and highly significant at 1 percent level. This is contrary to a prior expectation compared to other related studies; Adeogun *et al.* (2008), Adeniji (2002) owing to the fact that extension contact is a crucial factor that promotes adoption. However, the difference in opinion established in this research may be due to other factors which inhibit adoption having a stronger force (cost, complexity, relative advantage etc.) despite respondents' contact with extension agents.

Income (0.001) was positive and strongly significant at 1 percent level. This implies that income is a major determinant of adoption of innovation, hence the more income the more the probability of adoption of improved rice processing technologies

As anticipated, household size (-0.006) was negative and statistically insignificant. The implication is that large family size can be use as a substitute to hired labor or innovation thereby saving the cost of buying a particular innovation. This is in accordance to *a prior* expectation.

However, membership of co-operative with a coefficient of 0.294 was found to be positive and highly significant at1 percent level. This suggests that cooperative has a direct effect on adoption of improved rice processing technologies. Respondents belonging to cooperative are likely to be exposed to incentive or pull resources together to purchase innovation.

Distance from resident to processing facility (-0.051) was found to be negative and statistically insignificant. It implies that distance is not a determining factor for adoption. This is so because respondents that had a full conviction about a particular innovation will adopt despite distance from processing location.

Table 4.10 Probit Estimates of the Factors Influencing Adoption of Improved Rice Processing Technologies

Parameters	Coefficient	Standard Error	Z
Age (yrs)	0.016	0.005	3.520***
Experience (yrs)	-0.010	0.004	-2.472**
Education (yrs)	0.041	0.015	2.806 ***
Labor cost (₦)	0.001	0.000	-2.547**
Awareness (No. of innovations)	0.152	0.014	10.961**

Quantity processed (Kg)	0.004	0.000	18.756***
Extension contact (No. of visit)	-0.281	0.031	-8.958***
Income (₦)	0.001	0.000	22.542***
Household size (No. of persons)	-0.006	0.004	-1.459NS
Co-operative (₦)	0.294	0.106	2.774***
Distance (Km)	-0.051	0.048	-1.070***

Source: computed from Field data, 2012.

***= Significant at 1 percent **= Significant at 5 percent NS= Not Significant

4.6 Test of hypotheses

The hypotheses for this study were tested using probit regression model to test hypothesis 1 and student Z-test to test hypothesis 2.

4.6.1 Hypothesis 1

Hypothesis 1 of the study which states that there is no significant relationship between the socio-economic characteristics of women rice processors such as age, experience, awareness, labor cost, education, extension contact, income, quantity processed, household size and adoption of improved rice processing technologies was tested using the maximum likelihood estimates obtained from the probit regression model. A summary of the estimated coefficients is presented in Table 4.11.

The MLE estimates of the socio-economic characteristics of the respondents namely; age, experience, education, household size, income and labor affecting adoption were found to be significant at 1 and 5 percent significant levels respectively when regressed with the dependent variable adoption as presented in Table 4.11

The MLE estimate with respect to age was 3.520 and statistically significant at the 1 per cent level. We hereby reject the null hypothesis and accept the alternative hypothesis that there is a significant relationship between adoption and the age of the respondent.

Experience had a MLE of -2.472 and was statistically significant at 5 percent level. We hereby reject the null hypothesis and accept the alternative hypothesis which implies that there is a significant relationship between adoption and the experience of respondent.

The MLE estimate with respect to education of respondents was 2.806 and statistically significant at 1 percent level. Hence rejecting the null hypothesis and accept the alternative hypothesis which says that there is a significant relationship between adoption and education of respondent.

Moreso, labor cost had a MLE of -2.547 and was statistically significant at 5 percent level thereby rejecting the null hypothesis and accept the alternative hypothesis which implies that there is a significant relationship between adoption and labor cost.

The MLE with respect to awareness was 10.961 and was statistically significant at 1 percent level thus rejecting the null hypothesis and accepting the alternative hypothesis which says that there is a significant relationship between adoption and awareness.

Quantity processed had a MLE of 18.756 and was statistically significant at1 percent level. The null hypothesis is rejected and the alternative accepted. It therefore implies that there is a significant relationship between quantity processed and adoption.

Extension contact had a MLE of -8.958 and was statistically significant at 1 percent level. The null hypothesis was rejected and the alternative hypothesis was accepted. Hence there was a significant relationship between extension contact and adoption of improved rice processing technologies

The MLE with respect to income was -22.542 and was statistically significant at 1 percent level. The null hypothesis was rejected and the alternative hypothesis was accepted. This implies that there was a significant relationship between income of respondent and adoption of improved rice processing technologies

Household size had a MLE of -1.459 that was not statistically significant. Null hypothesis was accepted and alternative hypothesis rejected which says that there was no significant relationship between household size and adoption of improved rice processing technologies.

The MLE with respect to co-operative was 2.774 and statistically significant at 1 percent level. We rejected the null hypothesis and accepted the alternative hypothesis. This implies that there was a significant relationship between co-operative and adoption of improved rice processing technologies.

Distance had a MLE of -1.070 that was not statistically significant, thus accepting the null hypothesis. The implication is that there was no significant relationship between distance and adoption of improved rice processing technologies.

Table 4.11 A summary of the computed maximum likelihood estimates of factors affecting the adoption of improved rice processing technologies

Socio-economic variables	Z-values
Age (Yrs)	3.520***

Experience (Yrs)	-2.472**
Education (Yrs)	2,806***
Labor cost (₦)	-2.547**
Awareness (Number of innovation)	10.961***
Quantity processed (Kg)	18.756***
Extension contact (Number of visits)	-8.958***
Income (₦)	-22.542***
Household size (Number of person)	-1.459NS
Co-operative (₦)	2.774***
Distance (Km)	-1.070NS

Source: Computed from Field data, 2012.

***= Significant at 1 percent **= Significant at 5 percent NS= Not Significant

4.6.2 Hypothesis 2

Hypothesis 2: There is no significant difference between income realized by women before and after adopting improved rice processing technologies was tested using t-test.

The result from the analysis in Table 4.12 reveals that the calculated Z-value (-16.053) was significant at 1 percent level. This shows a significant difference in the output of respondents before and after adopting improved rice processing technologies. Therefore, we reject null hypothesis and accept alternative hypothesis. Hence, respondents that adopted improved rice processing technologies had great gain in terms of quantity of product as well as income.

Table 4.12 Test of Differences between the Respondents' Income Before and After Adopting Improved Rice Processing Technologies

	Mean	Std error	Z - value	df	Sig
Income before	42,110.83				
Income after	65,126.67				
Income before -Income after	-23,015.8	1,433.710	-16.053***	119	0.000

Source: computed from Field data, 2012.

***= Significant at 1 percent

4.7 Constraints Affecting Adoption of Improved Rice Processing Technologies

Result in Table 4.13 indicates the most pressing constraints encountered by the respondents in decreasing magnitude of importance are presented as follows:

An overwhelming majority of the respondent 93.3 percent of respondents were not having access to agricultural credit such as loan and some technologies that could be given out by private individuals and governmental organizations while only 6.7 percent had access to agricultural credit. This implies respondent inadequacy in having funds (90.8 percent) which hampers adoption of innovation since their purchasing power will be limited.

The third constraint identified by 49.2 percent of the respondents was the smallness. Respondents with frequent small quantity of paddy for a technology processing may not consider it wise to pay the same amount with those with large quantity of paddy in a single processing. This may lead to a decline in innovation adoption.

Nine point two percent did not have contact with extension agents. This shows the reason for high awareness (93.3 percent) recorded. Extension agents promote and propagate current innovations, but when their contacts with respondents are poor, awareness is also hampered as well as adoption of technologies.

Table 4.13 Distribution of Respondents According to Constraints Encountered in Adoption of Improved Rice Processing Technologies

	Yes			No	
Constraints	Frequency*	percentage	Rank	Frequency*	percentage
Inadequate access to agric. credit	103	85.8	1st	17	14.2
Inadequate fund	96	80.0	2nd	24	20.0
Smallness of paddy	59	49.2	3rd	61	50.8
Inadequate extension contact	11	9.2	4th	109	90.8
Inadequate awareness	8	6.7	5th	112	93.3

Source: Field survey, 2012. * implies multiple responses

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Respondents at a productive age were 88.3 percent with a mean age of 37 years. Majority were married (94.2 percent) with household size of 16-20 (47.5 percent). A significant proportion (34.2) had adult education with major occupation as trading and their years of experience in processing were between 11-20 representing 51.7 percent.

The result of analysis provided showed that respondents were aware of improved rice processing technologies; Large mills, medium mills, small mills, parboiler and cleaner had higher awareness levels of 99.2 percent, 99.2 percent, 99.2 percent 85.8 percent and 75.0 percent respectively while thresher, dryer and winnower had lower awareness levels of 54.2 percent, 50.0 percent and 29.2 percent respectively. Also the sources of awareness used were mostly extension agent (98.3 percent), farmers' group (85.8 percent) and friends (72.5 percent) while radio (0.8 percent), television (4.2 percent), village head (0.0 percent) and research institute (2.5 percent) were less used.

Results determining the level of adoption of improved rice processing technologies showed that small mills (100.0 percent), parboiler (84.2 percent) and cleaner (53.3 percent) had high adoption percentage while large mill (0 percent), medium (0 percent) winnower (0 percent), thresher (0.8 percent) and dryer (0 percent) had very low percentage.

Determining factors influencing adoption of improved rice processing technologies showed that eight dependent variables; age, experience, education, labor cost, quantity processed, extension contact, income and cooperation were significant at 1 and 5 percent levels while household and distance were not significant. The insignificant result showed that they had little or no effect on adoption of improved rice processing technologies.

Three constraints were established to limit adoption; inadequate access to agricultural credit, inadequate fund and smallness of paddy with percentages of 85.8, 80.0, 49.2 respectively.

The null hypotheses formulated for this study were rejected. Hence, there is a significant relationship between the socio-economic characteristics and adoption. Secondly, there was a significant different between income before and after adoption of improved rice technologies.

Therefore, results obtained from the analyses showed that adoption of improved rice processing technologies is still low due to certain factors that are not properly addressed such as; inadequate access to agric credit, inadequate fund and smallness of paddy.

5.2 Recommendations

Based on the findings, the following recommendations are made:

1. Forming of more co-operative so as to pull resources together to acquire need technologies and also financial institutions should create enabling environment for farmers to loans.

2. Technologies developers should take into consideration the financial capacities of intended users.

3. There should proper follow-up of women by extension workers to ensure appropriate utilization of technologies.

REFERENCES

Abebe, W. (2007). Determinant of Adoption of Improved Box in Atsbi Wemberta District of Eastern Zone, Tigray regin: A Master Thesis Submitted to the Department of Rural Development and Agriculture Extension School Graduate Studies, Haramaya University.

Abiodun, J. A. (2003). Evaluation of Fisheries Catch Trend on Lake Kainji, in Nigeria, *Journal of Applied Sciences and Environmental Management,* 7(2): 9-13.

Adebayo, C. O., Saleh, M. K., Alabi, O.O. & Durba, M. A. (2010). Assessment of Level of Women Farmers Adoption of Sasakawa Global Recommended Maize Production Technologies In Kaduna State, Nigeria. *International Journal of Agriculture and Development Economics,* 1(1): 34-40.

Adekoya, A. E. & Tologbonse, E.B. (2005). Adoption and Diffusion of Innovations. In: Adedoyin, S. F. (ed). *Agricultural Extension in Nigeria*. Pp 28-37.

Adeniji, O. B. (2002). Adoption of Improved Technologies for Cotton Production by Farmer in Katsina State, Nigeria. A Ph.D thesis Submitted to Department of Agricultural Economics and Extension, Ahmadu Bello University, Zaria, Nigeria.

Adeniyi, O. R. & Solomon, V. A. (2010). Analysis of the Relationship of Socio-economic Factors Affecting Adoption of Improved Oil Palm Production Technologies in Iwo Area of Osun State, Nigeria. *Nigerian Journal of Rural Sociology.* 11(2) : 11-17.

Adeogun, O. A., Ajana, A. M., Ayinla, O, A., Yarhere, M. T., & Adeogun, M. O. (2008). Application of Logit Model in Adoption Decision: A Study of Hybrid Clarias in Lagos. *A Journal of Agricultural and Environmental Science* 4 (4): 468-472

Adesina, A. A. & Baidu-Ferson, J. (1995). Farmers' Perception and Adoption of New Agricultural Technology: Evidence from Analysis in Burkina Faso and Guinea West Africa. *Agricultural Economics* 13: 1 – 9.

Adisa, R. S. & Adekunle, O. A. (2007). Information and Communication Technology in Non-Agricultural Enterprises for Rural Transformation in Kwara State, Nigeria. *International Journal of Agriculture and Rural Development* 9:16-21

Adhikarya, R. (1996). Implementing Strategic Extension Campaigns. In: Swanson, B.C., Bentze, R. P. and Sofranko, A. J. Improving Agricultural System. A Reference Manual FAO.

Agwu, A. E. (2004). Factors Influencing Adoption of Improved Cowpea Production Technologies. *A Journal of International Agricultural Extension and Education*. 3(4): 81-88.

Akande, T. (2000). “An Overview of Nigerian Rice Economy”. The Nigeria Institute of Social and Economy Research (NISER), Ibadan, Nigeria.

Akpokodje, G., Lancon, F. & Erentein, O. (2001). “Nigeria’s Rice Economy State of the Art” Paper presented at the NISER/WARDA Nigeria Rice Economy stakeholders Workshop, Ibadan, Bouake WARDA.

Alene, A. D & Manyong, V. M. (2007) “The Effects of Education on Agricultural Productivity Under Traditional and Improved Technology in Northern Nigeria: an Endogenous Switching Regression Analysis”, *Empirical Economics* 32: 141-159.

Alhaji, M. (2009). The Quality of Recovered Milled Rice Among Milling Stations. Unpublished B.Technology. thesis Summited to Department of Crop Science. Federal University of Technology, Minna, Niger State.

Baidu-Forson, J. (1999). Factors Influencing Adoption of Land Enhancing Technology in the Sahel: Lessons from a Case Study in Nigeria Agricultural Economics. *Agricultural Journal* 20: 231-339.

Bamidele, F. S., Abayomi O. O. & Esther, O. A. (2010). “Economic Analysis of Rice Consumption Pattern in Nigeria” *Journal of Agricultural Science Technology* 12:1-11.

Bamire, A. S. & Manyon,g B. (2003). Profitability of Intensification Technologies among Small Holder Maize Farmers in Forest Savannah Transition zone of Nigeria. *Agricultural Ecosystem Environment Journal* 100(1&2):111-118.

Bammeke, T. O. (2003). Accessibility and Utilization of Agricultural Information in the Economic Empowerment of Women Farmers in South West Nigeria. A Ph. D Thesis Submitted to Department of Agricultural Extension and Rural Development, University of Ibadan.

Banabana- Wabbi, J. (2002). Assessing Factors Affecting Adoption of Agricultural Technologies: A Case of Integrated Pest Management (IPM) in Kum District Eastern Uganda. Unpublished M. Sciences Thesis, Department of Agricultural and Applied Economics, Virgirnia Polytechnic Institute and State, University, U.S.A.

Berhanu, G. & Swinton, S. M. (2003). “Investment in Soil Conservation in Northern Ethiopia: The Role of Land Tenure Security and Public Programme”, *Agricultural Economics journal* 2(9): 69-84.

Chukwuji, O. C & Ogisi O. D. (2006). “A Tobit Analysis of Fertilizer Adoption by Smallholder Cassava Farmers in Delta State, Nigeria”, *Agricultural Journal* 1(4): 240-252.

Degnet, A. & Belay, K. (2001). Factor Influencing Adoption of High Yielding Maize Varieties in South Western Ethiopia: *An Application of Logit Quart Journal of Interna Agric.* 40(2): 149-167.

Deanhanger Project (2010). An Overview of the Expansion of Badeggi Rice Processing Company Lmited pp 1-3.

Effiong, E. O. (2005). Efficiency of Production in Selected Livestock Enterprises in Akwa Ibom State, Nigeria. Unpublished Ph.D dissertation. Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike.

Egunjobi, L. (1991). “On the Status of African Women” Peace Review, Winter 1991-1992 edition pp 56.

Ekong, E. E. (2003). *Rural Sociology*: An Introduction and Analysis of Rural Nigeria. 2nd edition published by Dove Educational Publishers, Uyo pp 279-282.

Ekong, E. E. (1988) Diffusion and Adoption of Agricultural Innovation; In: Ekong, E. E. (ed) *Rural Sociology* pp 323-343.

Ekong, E.W. (2000). Group and Non-group Women Farmers Access to Agricultural Production Responses in Akwa Ibom State, Nigeria. A Ph.D thesis Submitted to Department of Agricultural Extension and Rural Development, Ibadan: University of Ibadan.

Eluwa, S. A. (2010). Impact of Extension Agents on the Adoption of Rice Production Technologies Among Small Scale Farmer. Unpublished B. Tech thesis Submitted to Federal University of Technology, Minna.

Enitan, F.O. (2010). Influence of Socio-economic Characteristics on Use of Modern Cassava Processing Technologies Among Women Processors in Ogun State, Nigeria. *Journal of social Sciences* 24(1): 43-50.

Erentein, O., Akpokodje, G. & Lancon, F. (2003). Nigeria’s Rice Policy and Development. A paper review at WARDA, Abidjan. pp 1-9.

Erinle, I. D. (1994). The Need for an Effective Agricultural Research Programme. In: Shuiab, B. *Research System*. NARP Abuja pp 77-88.

Ezedinma, C. I. & Atala, T. K. (2002). Impact of Inter-regional Trade on Development of Rice Producing Areas in Nigeria. A Research Draft.

Ezedinma, C. I. (2005). Impact of Trade on Domestic Rice Production and the Challenges of Self-sufficiency in Nigeria. IITA, Ibadan, Nigeria.

Fagade, S.O. (2000). Yield Gaps and Productivity Decline in Rice Production in Nigeria. A paper presented at the Expert Consultation on Yield Gap and Production in Rice, FAO, Rome Italy pp15.

Fakoya, E. O., Apantaku, S. O., & Unaeze, C. E. (2001). Women's Participation in Sustainable Crop Farming Activities in Odeda Local Government Area, Ogun State. *Journal of Environmental Extension* 2(1): 24-30.

Fashola, O. O., Oladele, O. I., Alabi, M. O., Tologbonse, D. & Wakatsuk, T. (2007). Socio-economic Factor Influencing the Adoption of Sawah Rice Production Technology in Nigeria. *Journal for Food, Agriculture and Environment* 5(1): 242-259.

Feder, G., Just, R. E. & Zilberman, D. (1985). "Adoption of agricultural innovations in developing countries: A survey", *Economic Development and Cultural Change.* 33(2): 255- 298.

Fliegel, F. C. (1984). Extension Communication and Adoption Process. In Swanson, B. C. (ed). Agricultural Extension. A Reference Manual pp 77-88.

Floyd, C. N., Harding, A. H., Paddle, K. C., Rasali, D. P., Subedi, K.D. & Subedi, P. P. (1999). The Adoption and Associated Impact of Technologies in the Western Hills of Nepal. *Oversea Development Institute Agricultural Research and Extension Network paper* No. 90.

Food and Agricultural Organization (FAO)(FAO, 2004). FAO Rice Conference 2004. Accessed online at www.fao.org on 12th August 2011.

Food and Agricultural Organization (FAO)(FAO, 2002). FAO Rice Conference 2002.Accessed online at www.fao.org on 12th August 2011.

Food and Agricultural Organization (FAO) (FAO, 2001). FAO Rice Conference 2001. Accessed online www.fao.org on 11th Nov. 2011.

Fufa, B & Hassan, R. M. (2006). "Determinants of Fertilizer Use on Maize in Eastern Ethiopia: Weighted Endogenous Sampling Analysis of the Extent and Intensity of Adoption" *Agrekon* 45(1):38-49. http://purl.umn.edu/31734 (Last consulted: 10 June 2009).

Herdt, R. W. & Capule, C. (1983). Adoption, Spread and Production Impact of Modern Rice Varieties in Asia. International rice Institute, Los Baanos, Laguna, Philippines.

Idrisa, Y. L., Ogunbameru, B. O., & Amaza, P. Z. (2010). Influence of Farmers' Socio-Economic and Technology Characteristics on Soybean Seeds Technology Adoption in Southern Borno State, Nigeria. *African Journal of Agricultural Research* 5(12):1394-1398.

Ilevbaoje, I. E. (2005). Extension Teaching Method for Accelerated Adoption of Rice Technologies pp 240.

International Rice Research Institute (IRRI) (IRRI, 2001). Rice Statistic. Accessed online at http://oryza.com/africa/nigeria/index.shtml on 12th August 2011.

Inusa, G. A. (2010). Analysis of Factors Affecting Adoption of Improved Groundnut Production Technologies. A Ph. D Thesis Department of Agricultural Economic and Extension , Ahmadu Bello University, Zaria, Nigeria.

Issaka, R. N., Buri, M. M. & Wakatsuki, T. (2008). *The Sawah System of Rice Production.* Soil Research Institute Sawah Project, Ghana pp 1.

Jahannes, T. A., Vabi, M. B. & Malaa, D. K. (2010). Adoption of Maize and Cassava Production Technologies in Forest Savanna zone of Cameroun. Implication for Poverty Reduction. *World Applied Sciences Journal* 11(2): 196-207.

Jibowo, A. A. (1992). Rural Social Change; In Jibowo A. A. (ed) Essentials of Rural Sociology; Cobemi Sodipo press, Abeokuta, Ogun State pp. 215-228.

Jiggins, J., Sananta, R. & Olawoye J. B. (1997). Improving Women Farmer's Access to Extension Services in F.A.O ; Improving Agricultural Extension, F.A.O. Rome.

Lancon, F., Erentein, O., Akande, S. O.,Titilola, S.O. Akpokodje, G. & Ogundele, O. O. (2003). Rice Production in Nigeria: A survey. Abidjan; WARDA.

Langtau, S.R. (2003). A Review and Description of Rice Production Systems in Nigeria. Ecosystem Development Organisation. Jos, Nigeria.

Misari, S. M., Ojehomon, O. & Singh, B. N. (1997). "Appropriate Machining and Processing Technics" Small Scale Option for Nigeria Self Sufficient In Rice Production.

National Cereals Research Institute (NCRI)(NCRI, 2008).Training workshop Manual on Rice Production and processing, Niger State, Nigeria pp 86-93.

National Population Commision (NPC) (NPC, 2006). Niger State diary.

Niger State Agricultural Development Programme (NSADP), (NSADP,1994). Impact Study Final Report. Agricultural Development programme planning unit, Minna pp 24.

Niger State geographical location. Wikipedia (2006); C-GDD (Canback Global Income Distribution Database). Retrieved 2011-09-17.

Nkonya, E., Schroeder, T. & Norman, D. (1997). "Factors Affecting the Adoption of Improved Maize Seeds and Fertilizer in Northern Tanzania", *Journal of Agricultural Economics* 48(1): 1-12.

Nwachukwu, I. & Jibowo, A. A. (2000). Evaluation of the Utilization of Rice Processing Technology Among Women Farmers and Central Zone, Nigeria. *Journal of Agricultural Extension* 4 (1): 63-64.

Nwaru, J. C. (2004). Rural Credit Markets and Arable Crop Production in Imo State. Unpublished Ph.D Dissertation. Michael Okpara University of Agriculture Umudike, Nigeria.

Odebode, S. O. & Mungong, C. H. (2001). Poverty Alleviation Strategies of Rural Households in Mezam Division, North West Province, Cameroon. *Moor Journal of Agricultural research.* 2(2): 179-185.

Ojo, M. A., Mohammed, U. S., Olaleye, R. S. & Ojo, O. A. (2009). Return to Scale and Determinant of Farm Level Technical Inefficiency Among Small Scale Yam base Farmers. Implication for food security*: International Journal for Agricultural Economics and Development* 2 (1): 43-51.

Okoruwa, V., Ogundele, O. O. & Oyewusi, B. O. (2007*).* Productivity Efficiency of Nigerian Farmers*:* A Case of Rice Farmers in North Central Nigeria. *China Agricultural Economics Review* 5(4).

Okoye, B. C., Okorji, E. C. & Asumugha, G. N. (2004). Outlook in Production Economics of Paddy Rice under Resource Constraints in Ebonyi State. Procedure of the 38th Annual conference of Agricultural Society in Nigeria (ASN), Lafia, Nasarawa State pp 337-342.

Okoye, B.C., Okoye, A.C., Dimelu, M. U., Agbaeze, C. C., Okoroafor, O. N. & Amaefula, A. B. (2008). Adoption Scale Analysis of Improved Cocoyam Production, Processing and Storage Technologies Across Gender in Enugu North Agricultural Zone, Nigeria.

Okunade, E. O. (2006). Factors Influencing Adoption of Improved Farm Practices Among Women Farmers in Osun State. *Journal Hum Ecology*, 19(1):45-49.

Omonona, B. T., Oni, O. A. & Uwagboe, A. O. (2005). Adoption of Improved Cassava Varieties its Welfare Impact on Rural Farming in Edo-State, Nigeria. *Journal of Agricultural Food Information* 3(1): 39-55.

Onyemobi, F. I. (2000). Towards Agricultural Revolution and rural development. In

Onyemobi, F. I. (ed): *Women in Agricultural and Rural Development Towards Agricultural Revolution in Nigeria*, Enugu, Nigeria.

Oshaduma, D. (2010) Farmers Perception on the Relevance of Improved Agricultural Technologies in Rice Production: A Case Study of Katcha L.G.A. Niger State. A (B.Tech) Project of Department of Agricultural Economics and Extension Submitted to Federal University of Technology, Minna.

Otite, O. & Ogionwo, W. (2003). *An Introduction to Sociological Studies*. (1st ed.) published by Heinemann Educational books, Ibadan, Nigeria pp153-157.

Pannell, D. J., Marshall, G. R., Barr, N., Curtis, A., Vanclay, F. & Wilkinson, R. (2006) Understanding and Promoting Adoption of Conservation Practices by Rural Landholders. *Australian Journal of Experimental Agriculture* 46(11): 1407-1424.

Peter, A. & David, R. L. (2003). The Determination of Adoption of Sustainable Agriculture Technologies. Department of Applied Economics and Management, Cornell University, Ithaca, Ny, U.S.A.

Phillip, D., Maiangwa, M. & Phillip, B. (2000). Adoption of Maize and Related Technologies in the North West Zone of Nigeria. *Moor Journal of Agricultural Research.* 1(1): 98-105.

Polson, R. A & Spencer, D. S. (1991). "The Technology Adoption Process in Subsistence Agriculture" The Case of Cassava in Southwestern Nigeria. Agricultural System pp 36.

Rogers, E. M. (1996). *Diffusion of innovation*, 4th edition, New York: Free press.

Roling, N. & Pretty, J. N. (1996). Extension Role in Sustainable Agricultural Development In: Swanson, B.C., Bentze, R. P. and Sofranko, A.J. Improving Agricultural Extension*: A Reference Manual* FAO Rome. pp 175-184.

Saliu, O. J. & Adedayo, F.H. (2010). Non Farm Income and Technology Adoption Among Rural Farmers in Yagba East Local Government Area, Kogi State, Nigeria. *Nigerian Journal of Rural Sociology* 11(2):50-57.

Sall, S., Norman, D. & Featherstone, A. M. (2000). "Quantitative Assessment of Improved Rice Variety Adoption: The Farmer's Perspective", *Agricultural Systems* 66:129-144.

Saka, J. O. & Lawal, B. O. (2009). Determination of Adoption and Productivity of Improved Rice Varieties. *African Journal of Biotechnology* 8 (19): 4923-4932.

Sanginga, P. C. (1998). Adoption and Social Impact Assessment of Improved agricultural Technologies: the Case Soybean in Benue State, Nigeria. Ph.D Thesis, University of Ibadan, Nigeria.

Sulo, T., Koech, P., Chumo, C. & Chepng'eno, W. (2012). Socio-economic Factors Affecting the Adoption of Improved Agricultural Technologies Among Women in Marakwet County, Kenya. *Journal of Emerging Trends in Economics and Management Sciences* (JETEMS) 3(4):312-317.

Swanson, B. E. (1996). Strengthening Research-Extension-Farmer Linkages. In: Swanson, B, E; Benz, R. P. and Sofranko, A. J (ed) *Improving Agricultural Extension: A Reference Manual*, pp 165-167.

The Cambrige World History of Food- Rice mht. Edited by Kenneth F. Keple & kriemhild conee Ornelas. Retrieved 30/06/2011.

Van den Ban & Hawkins, H. S. (1996). Agricultural Extension. 2nd edition, Blackwell Science Ltd, London. pp 96-119.

Yate, R. A. (1995). Method of Technology Transfer for Agricultural Development in Subsahara Africa. In Kana, B. T; Abiodun, V. M; Manyong, R. J; Carsky, N; Sanginga and Kueneman, E. A. (ed). Moist Savanna of African Potential and Constraint for Crop Production. *Proceedings of International Workshop Held in Cotonou*. pp 187-204.

West African Rice Development Association (WARDA) (WARDA, 2007). African Rice Trend; Overview of Recent Development in Sub-Sahara African Rice Sector. Africa Rice Centre Brief Cotonou, Benin WARDA pp 8.

West African Rice Development Association (WARDA) (WARDA, 2008). NERICA: The New Rice for Africa (NERICA) - a Compendium. E. A Somado, R. G. Guei and S.O. kenya (eds). Cotonou, Benin. Africa Rice Centre (WARDA) Rome, Italy FAO; Tokyo, Japan; Sasakawa Africa Association pp 210.

Wikipedia 2008 www./nigerstatepopulation.org/ retrieved 18/11/2011. 5.30pm

Wikipedia 2011 www./improvetechnology.org/ retrieved 18 /11/2011.6pm.

Wikipedia 2012 www./improvedtechnologies.org/ retrieved 12/11/2012. 12:15pm

Zurek, M. B. (2002). Induced Innovation and Productivity-Enhancing, Resource-Conservating Technologies in Central America: The Supply of Soil Conservation Practices and Small Scale Farmers' Adoption in Guatemala and El Salvador. Unpublished Ph.D Dissertation, Justus Liebig University, Giessen, Germany.

APPENDIX A

DATA ANALYSIS

[DataSet1] C:\Users\OJO FAMILY\Documents\Akin folder\Student data 2012\Fidelis.save

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 21yrs	1	.8	.8	.8
	21-30yrs	26	21.7	21.7	22.5
	31-40yrs	40	33.3	33.3	55.8
	41-50yrs	40	33.3	33.3	89.2
	51-60yrs	11	9.2	9.2	98.3
	Greater than 60yrs	2	1.7	1.7	100.0
	Total	120	100.0	100.0	

Marital status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	4	3.3	3.3	3.3
	Married	109	90.8	90.8	94.2
	Divorced	3	2.5	2.5	96.7
	5	4	3.3	3.3	100.0
	Total	120	100.0	100.0	

Household size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5	2	1.7	1.7	1.7
	6-10	24	20.0	20.0	21.7
	11-15	36	30.0	30.0	51.7
	16 - 20	57	47.5	47.5	99.2
	Greater than 21	1	.8	.8	100.0
	Total	120	100.0	100.0	

Religion

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Christianity	33	27.5	27.5	27.5
	Islamic religion	87	72.5	72.5	100.0
	Total	120	100.0	100.0	

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tertiary edu	1	.8	.8	.8
	Primary edu	31	25.8	25.8	26.7
	Secondary edu	25	20.8	20.8	47.5
	Adult education	41	34.2	34.2	81.7
	Quaranic edu	17	14.2	14.2	95.8
	Others	5	4.2	4.2	100.0
	Total	120	100.0	100.0	

Years of experience in processing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5yrs	27	22.5	22.5	22.5
	6-10yrs	69	57.5	57.5	80.0
	11-15yrs	24	20.0	20.0	100.0
	Total	120	100.0	100.0	

Major occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Farming	21	17.5	17.5	17.5
	Trading	99	82.5	82.5	100.0
	Total	120	100.0	100.0	

Manual

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	120	100.0	100.0	100.0

Mechanical

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	120	100.0	100.0	100.0

Large, medium and smaller

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	1	.8	.8	.8
	Yes	119	99.2	99.2	100.0
	Total	120	100.0	100.0	

Winnower

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	85	70.8	70.8	70.8
	Yes	35	29.2	29.2	100.0
	Total	120	100.0	100.0	

Parboiler

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	17	14.2	14.2	14.2
	Yes	103	85.8	85.8	100.0
	Total	120	100.0	100.0	

Thresher

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	55	45.8	45.8	45.8
	Yes	65	54.2	54.2	100.0
	Total	120	100.0	100.0	

Dryer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	59	49.2	49.6	49.6
	Yes	60	50.0	50.4	100.0
	Total	119	99.2	100.0	
Missing	System	1	.8		
Total		120	100.0		

Cleaner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	30	25.0	25.0	25.0
	Yes	90	75.0	75.0	100.0
	Total	120	100.0	100.0	

Result on productivity in terms of quality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	34	28.3	28.3	28.3
	Very good	67	55.8	55.8	84.2
	Good	19	15.8	15.8	100.0
	Total	120	100.0	100.0	

Large, medium and smaller

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	120	100.0	100.0	100.0

Winnower

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	120	100.0	100.0	100.0

Parboiler

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	19	15.8	15.8	15.8
	Yes	101	84.2	84.2	100.0
	Total	120	100.0	100.0	

Thresher

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	120	100.0	100.0	100.0

Dryer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	119	99.2	99.2	99.2
	Yes	1	.8	.8	100.0
	Total	120	100.0	100.0	

Cleaner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	56	46.7	46.7	46.7
	Yes	64	53.3	53.3	100.0
	Total	120	100.0	100.0	

Extension agents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	2	1.7	1.7	1.7
	Yes	118	98.3	98.3	100.0
	Total	120	100.0	100.0	

Radio

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	119	99.2	99.2	99.2
	Yes	1	.8	.8	100.0
	Total	120	100.0	100.0	

Television

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	115	95.8	95.8	95.8
	Yes	5	4.2	4.2	100.0
	Total	120	100.0	100.0	

Village head

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	120	100.0	100.0	100.0

Farmers'group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	17	14.2	14.2	14.2
	Yes	103	85.8	85.8	100.0
	Total	120	100.0	100.0	

Research institute

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	117	97.5	97.5	97.5
	Yes	3	2.5	2.5	100.0
	Total	120	100.0	100.0	

Friend

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	33	27.5	27.5	27.5
	Yes	87	72.5	72.5	100.0
	Total	120	100.0	100.0	

Z- test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Income before	42110.83	120	11853.878	1082.106
	Income after	65126.67	120	16253.531	1483.738

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Income before & Income after	120	.410	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Income before - Income after	-23015.8	15705.504	1433.710	-25854.7	-20176.9	-16.053	119	.000

Probit analysis

Data Information

		N of Cases
Valid		107
Rejected	Missing	0
	Number of Responses > Number of Subjects	13
Control Group		0

Convergence Information

	Number of Iterations	Optimal Solution Found
PROBIT	20	No [a]

a. Parameter estimates did not converge.

Parameter Estimates

	Parameter	Estimate	Std. Error	Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PROBIT [a]	Age	.016	.005	3.520	.000	.007	.025
	Experience	-.010	.004	-2.472	.013	-.018	-.002
	education	.041	.015	2.806	.005	.012	.069
	Labour cost	.000	.000	-2.547	.011	.000	.000
	Awareness	.152	.014	10.961	.000	.125	.179
	Qty processed	.004	.000	18.756	.000	.003	.004
	Extension contact	-.281	.031	-8.958	.000	-.342	-.219
	Income	.000	.000	-22.542	.000	.000	.000
	Hhsize	-.006	.004	-1.459	.144	-.014	.002
	Coop	.294	.106	2.774	.006	.086	.501
	Distance	-.051	.048	-1.070	.285	-.144	.042
	Intercept	-.614	.266	-2.310	.021	-.880	-.348

a. PROBIT model: PROBIT(p) = Intercept + BX

APPENDIX B

QUESTIONNAIRE

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

SCHOOL OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY,

AGRICULTURAL ECONOMICS AND EXTENSION TECHNOLOGY.

DEAR SIR/MADAM,

I am a post graduate (masters) student of Federal University of Technology, Minna in the above mention department. I am conducting a research on the adoption of improved rice processing technologies by women in Minna metropolis, Niger State. This research project is purely for academic purpose and all information generated would be used strictly to improve farmers' adoption of improved rice processing technologies in processing of rice in the study area. You are requested to kindly answer the question as objectively as possible by ticking the appropriate option(s) in the space provided or by writing short or direct answers as the case may be. Thanks for your co-operation.

Yours faithful,

Ajuonuma, Edima Fidelis

SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

1. LGA/Village...
2. Age. ....
3. Sex Male ( ) Female ( )
4. Marital Status (a) Single ( ) (b) Married ( ) (c) Divorced ( ) (d) Widow ( )
5. Household size (a) 1-5 ( ) (b) 6-10 ( ) (c) 11-15 ( ) (d) 16-20 (e) 21 and above ( )
6. Religion (a) Christian ( ) (b) Moslem ( ) (c) Traditional ( ) (d) Others (specify)...

7. Educational Level (a) Tertiary Education ( ) (b) Primary education ( )

(c) Secondary education ( ) (d) Adult education ( ) (e) Quranic education ( ) (f) Others (specify)...

B. Adoption/ Production information

1. Number of years spent in the rice processing business ....

2. Major occupation (a) Farming ( ) (b) Trading ( ) (c) Civil Service ( )

3. What type of labour do you use for processing? (a) manual ( ) (b) mechanical

4. Location of technology (a) 1-5km ( ) (b) 6-10km ( ) (c) 11-15km ( ) (d) 16-20km

5. What are the names of improved processing technologies communicated to you?

   (a) large, medium and small miller ( ) (b) Winnower ( ) (c) Parboiler ( ) (d) Thresher ( ) (e) Dryer ( ) (f) Cleaner ( ) (g) all ( )

6. If use, how will you assess the result on your productivity in terms of quality?

   (a) Excellent ( ) (b) Very good ( ) (c) Good ( ) (d) Bad ( ) (d) Very bad ( )

7. Which of the technologies mentioned in no. 5 have you adopted?..........................

8. How much do you produce when using the improved technologies monthly?

9. What are the sources of information on the technologies? (a) Extension agents ( ) (b) radio ( ) (c) television (d) village Head ( ) (e) farmers group ( ) (f) research institute ( ) (e) friend ( )

10. Have you had increase in income as a result of adopting improved practices?

    Yes ( ) No ( )

C. Cooperative/farmers association

1. Do you belong to any voluntary organisation? Yes (   ) No ( )

2 What are the main functions of your cooperative (tick as many as applicable)

(a) Financial assistance (   ) (b) to transport and market produce (   )

Others (specify)...

3. Why did you join the cooperative?

(a) Credit assistance (   ) (b) My neighbour asked me to join (   ) (c)

D. Extension contact

1. Do you have any contact with extension agents? Yes (   ) No (   )

2. How often does he/she visit you? Weekly (   ) bi-weekly (   ) Monthly (   )

bi-monthly (   ) Seasonally (   ) Yearly (   )

3. Are you satisfied with the visit? Yes (   ) No (   )

4. Have you received any advice on processing technologies? Yes (   ) No (   )

5. If yes, on what were you adviced?...

6. How often have you benefited from the advice?

i) Very often (   )
ii) Often (   )
iii) Occasionally (   )
iv) Rarely (   )
v) Never (   )

7. Do you agree with the extension agents recommendations on improved processing

Yes (   ) No (   )

8 If No give reasons (tick the appropriate)

Not practicable (   ) Expensive (   ) No fund (   ) Not practicable in our locality (

9. If yes, have you practiced the recommendations? Yes (   ) No (   )

10. What was your result obtained?

Excellent (   ) Good (   ) fair (   ) Bad (   )

11. Is there any difference in your output as a result of adoption of improved technologies Practiced? Yes (   ) No (   )

12. What is your opinion about the recommended practices?

I. it is a way of improving production (   )

II. Some information are not applicable (   )

III. Not sure of the relevance of the information (   )

IV. No response (   )

13. Do you communicate your observation/reaction about what you learnt on improved Practices to other source? Yes (   ) No (   )

14 What method do you use?

I. send a memo (   )

II. through personal visit to the station (   )

III. media forum/field day (   ) IV. through village extension workers ( ) V.

others (specify)..

E. Output Information

What is the total quantity sold and income released before and after adopting improved rice technologies.

Foodstuff	Price/bag	Total No. Of bag produced	Quantity sold	Income from sale before and after (#)
Rice				

F. How much do you pay on labour for each processing operations

S/NO	Operation	Am		AF		CH		Total	Amount
1	Threshing								
2	Winnowing								
3	Cleaning								
4	Parboiling								
5	Drying								
6	Milling								
7	Destoning								
8	Bagging								

G. Do you have access to agricultural credit

(a) Yes (b) No

If yes, through what source?

Source	Amount received (#)	Amount repaid (#)

a). Commercial Bank b). Co-operative c). Local Money Lenders e). Others (specify)		

F. Constraints faced by the respondents in the use of improved processing technologies

1. What are the factors militating against your adoption of improved rice processing technology? (a) lack of awareness (b) lack of fund (c) no access to agricultural credit (d) the smallness of paddy (e) lack of extension contact.

2. What are the limitations encountered during the adoption of improved rice processing technology? ......

I. Lack of competent engineers

II. Machines are not properly maintained.

III. Lack of follow-up by Extension agents

3. What recommendations would you like to give for the improvement on the adoption of improved rice processing technology?

I. Appropriate and timely information about rice processing.

II. Training the engineers operating the technology

III. Availability and nearness of the technology to the people

IV. Technology should be subsidized by government