

**FACTORS INFLUENCING ADOPTION OF RECOMMENDED RICE
PRODUCTION PRACTICES AMONG WOMEN RICE FARMERS IN
WESTERN ZONE OF NASARAWA STATE**

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE
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**DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY,
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AHMADU BELLO UNIVERSITY
ZARIA, KADUNA STATE
NIGERIA**

OCTOBER, 2015

DECLARATION

I hereby declare that this dissertation titled **“Factors Influencing Adoption of Recommended Rice Production Practices among Women Farmers in Western Zone of Nasarawa State”** has been written by me and it is a record of my research work. No part of this work has been presented in any previous application for another Degree or Diploma in this or any other institution. All borrowed information have been duly acknowledged in the text and a list of references provided.

Joyce Hauwa KAGBU
Student

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CERTIFICATION

This dissertation titled: **“Factors Influencing Adoption of Recommended Rice Production Practices among Women Farmers in Western Zone of Nasarawa State”** written by Joyce Hauwa **KAGBU** meets the regulations governing the award of the degree of Masters of Science in Agricultural Extension and Rural Sociology of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to my late Husband Professor James A. Kagbu who was very concerned about my education. For that is how God has planned it. Continue to rest with the Lord until we meet to part no more. Adieu.

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LIST OF ABBREVIATIONS USED IN THE TEXT

Abbreviations	Full meaning
ADPs	Agricultural Development Programmes
BEA(WIA)	Block Extension Agent (Women in Agriculture)
FDAE	Federal Department of Agricultural Extension
FMARD	Federal Ministry of Agriculture and Rural Development
FNTs	Fourthnightly Trainings
NAERLS	National Agricultural Extension and Research Liaison Services
NPAFS	National Programme on Agriculture and Food Security
RRPPs	Recommended Rice Production Practices
VEAs	Village Extension Agents
WHO	World Health Organization

ABSTRACT

This study assessed the factors influencing adoption of recommended rice production practices by women farmers in western zone of Nasarawa State. A total of 203 women rice farmers were selected for the study using multi-stage sampling technique. Data were collected using structured interview schedule. Descriptive statistics (mean and percentages) and inferential statistics (Multiple regression and t-test) were used for data analysis. The results obtained revealed that majority (70.9%) of the respondents were less than 45 years old married (82.5%), had below secondary education (80%), had household-size of between 6 and 9 (40.2%), had farming experience of 10 years and above (80%), and inherited their farmlands (81.4%). Majority (75.5%) of the women rice farmers cultivate 1 hectare of land and below. Only 23% of the women rice farmers had between ₦150, 001 - 200,000 annual farm income. Personal savings was the major source of credit ($M=2.56$). Majority (78.4%) of the women rice farmers received not more than ₦60,000 credit in the last one year. ADP was the most important sources of information for the women rice farmers ($M=2.12$). Women rice farmers' perception of technological attributes of RRPPs was high (2.13). Women rice farmers were aware of all the RRPPs except recommended seed rate and plant spacing. Harvesting (2.44), fertilizer application (2.29), and weeding (2.20) were the most adopted RRPPs. The output of majority (90.2%) of the women rice farmers remained the same in the last three years (4.21). In the same vein, income of majority (85.3%) had remain the same in the last three years. Results of multiple regression analysis of factors influencing adoption of RRPPs revealed that farm size (2.6353, $P<0.01$), amount of credit assessed (0.1618, $P<0.01$), membership of association (-0.3248, $P<0.01$), relative advantage (0.2337, $P<0.01$), compatibility (0.3519, $P<0.01$) and complexity (-0.1251, $P<0.05$) significantly influenced adoption of RRPPs by women rice farmers in the study area. Unavailability of credit facilities, poor marketing system and unstable price; as well as inadequate extension contacts were indicated by 92.1%; 64%; and 61.6% of the women rice farmers respectively as constraints to adoption of RRPPs. This study concludes that adoption of RRPPs was significantly influenced by farm size, credit received, relative advantage, and compatibility. Based on the findings of this study, it was recommended that government should ensure that credit facilities are made available on regular basis to women farmers. Also, buy-back arrangement should be introduced in order to ensure good pricing for rice producers.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Agriculture constitutes the main source of livelihood of people in many parts of the world. In Nigeria, agriculture is one of the most important sector of the Nigerian economy which provides employment opportunity for about 70-80 percent of the total population most of whom are practicing farming at subsistence level (Akande, 2000). The National Policies on agricultural food production in Nigeria has explicitly made several efforts in an attempt to address the need to increase food production in order to meet the food security objectives by giving priority to self-sufficiency in staple food production especially rice among other food crops in Nigeria (Ayoola, 2007).

Rice is from the family, Gramineae, Genus; *Oryza* and species: *sativa* L. and *Glaberrima*. It was taken to West Africa in the early 19th century (Jirgi *et al.*, 2009). Rice is the staple food for about half of the human race. It is the leading cereal crop which can be grown in the standing water of areas of flat, low-lying tropical soils. West African Rice Development Association (WARDA) (2006) projected growth in rice consumption for Nigeria as high as 4.5 percent per annum. In response to the growing demand for this staple food crop, governments at various periods actively interfered in the economy coming up with policies and programme to this effect. An estimate of locally produced rice for the year 2002 was 2.9 million tons (WARDA, 2003; Imolehin and Wada, 2000). Also, only about 67 percent of the 25 million hectares of land cultivated to various food crops were cultivated to rice between 2000 and 2002 (Obinna, 1991). Throughout the period, rice output increased, but decreased in 1991-1995 periods. Rice yield could increase due to growers using improved rice varieties which have potential to improve nutrition, boost food security, foster rural development and support sustainable land care (Jirgi *et al.*, 2009).

Rice forms a significant portion of food consumed in most households in Nigeria. In some countries, the per capita consumption of rice is estimated at more than 100kg / year. Demand for rice production is increasing and greater production is needed to feed more people and reduce the costly imports. Rice is important cereal for human consumption, as it provides 23% of global human per capita energy and 16% of per capita protein (Juliano, 1985). Rice protein contains high lysine and contains amino acid, it is important in making beer, rice-wine, and vinegar. Rice oil extracted from the bran is rich in vitamin E (Ezekiel *et al.*, 2009).

Unfortunately, the domestic production of rice has not met the demand, leading to food shortage problems. FAO (2002) projected annual growth in rice consumption for Nigeria as 4.5% beyond 2000. In a bid to address the demand/supply gap for rice, the

government at various times had come up with policies and programmes such as rice importation to supplement the local production which no doubt continues to drain the country's hard earned foreign exchange earnings. FAO (2008) estimated that Nigerian rice import increases from 2630 tonnes in 1980 to 1876 million tonnes in 2002. The total import also stood at 1.9 million tonnes in 2003 (CBN, 2004). However, continued fluctuation in rice production in the country is an indication of limited capacity of the Nigeria rice economy to match the domestic demand which can be attributed to the inability of the rice farmers to obtain maximum output from the resources committed to the enterprise (Kolawole, 2010). For instance, an average yield of rice in Nigeria is 1.8 tonnes / hectare compared to 3.0 tonnes / hectare from a country like Cote d'Ivoire and Senegal (WARDA and NISER, 2001). The existing level of production in rice in the country reflects low level of production efficiency of rice farmers in the country as this is a serious problem in achieving food security in the country.

The need for increase in rice production is necessary because rice is an important staple food crop in Nigeria and has occupied both social and economic place of farming among all agrarian communities across the country. The social aspect of rice production has to do with its ceremonial importance while the economic aspect of rice production among peasant farmers has to do with the fact that many rural families depends on the income generated from rice production enterprise to solve their daily problems (NCRI, 2011).

In Nigeria, rice grown on 1.77 million hectares ranks fifth after sorghum (4.0m ha), millet (3.5m ha.) cassava (2.0m ha) and yam (2.0mha), but if placed on a social scale, it can well be ranked first because it is no longer just a mere festival meal as in the past, but the staple of most homes in urban, and rural area (Longtau, 2003). Nigeria is endowed with favourable ecologies for rice cultivation. Virtually all the rice growing ecologies (the upland irrigated, inland valley swamp, deep water floating and tidal mangrove swamp) abound in Nigeria. Estimates by WARDA (1999), Singh et.al. (1997) and Imolehin and Wada (2000) put potential and actual areas for rice production at 4.6-4.9 million hectares and 1.77 million hectares respectively. Out of the actual land area under rice an estimated output of 2.3 million tonnes are realized (NCRI, 1997). This translates to a low productivity of about 1.3 tonnes per ha. Given this low productivity, the technical efficiency of rice farmers need be analysed and the technical inefficiency factors identified so as to realize Nigeria's rice policy objectives.

Nasarawa State is one of the major rice producing areas in Nigeria where production capacity was estimated at 655,000 metric tons/ha from 2003-2008 (NADP, 2010). Between 2007 and 2014, an estimated land area of 642.16 ha produced an estimated 1,449,000 metric tonnes of rice

Akpokodje and Erenstein (2004) stated that the need for improvement in rice production among other staple food crops is owing to the fact that rice is preferred among other staple food crops due to its ceremonial value among other cereal crops in Nigeria. This

also account for the country's high demand and the importation of about 40% of its rice requirement per annum. Thus, available statistics from the Food and Agriculture Organization (FAO, 2002) also revealed that Nigeria is the largest rice importer in West Africa with an average imports of 1.13 million metric tons of milled rice per annum at a huge cost of about US\$0.9 billion (₦135 billion).

Over the past two decades, rice has established itself as a preferred staple food crop in Nigeria due to the fact that rice is easier and faster to cook than other cereal crops. This has also been responsible for the experience increased in the demand for rice in Nigeria (FAO, 2006). Akande (2003) attributed urbanization as the most important cause of the shift in consumer preference towards rice in Nigeria. This consumer preference for rice is attributed to the variety of forms used in preparing rice for human consumption. These forms includes milked (polished) rice, pastries, noodles, popped rice, puffer rice, fermented sweet rice and snack foods such as crackers, confectionary such as ice creams, pudding, and pastry use in making of rice wine, beer, spirits and vinegar.

Rural women farmers play a vital role in food production and food security. They account for 70% of agricultural workers, 80% of food producers, 100% of those who process basic foodstuffs and they undertake from 60% to 90% of the marketing (Fresco, 1998). Four of ten agricultural workers in the world are women (United Nations., 1986). Women take part actively in farming activities and in processing farm products, in addition to their domestic and reproductive responsibilities. It is often stated that women are responsible for more than half the world's food production overall and produce up to 60 to 80% of basic foodstuff in Africa (Fresco, 1998). The role women play in agriculture and the rural society is fundamental to agricultural and rural development in sub-Saharan Africa.

In Nigeria, women supply most of the needed labour in agricultural activities and this is the most important factor of production to farmers, as it is needed at the stages of agricultural production. Yahaya (2002) recorded that 76% of women from Oyo and Bauchi State are actively involved in farming activities or are engaged in their husband's farms.

It has been reported by different authors that inadequate information about the improved technologies was one of the constraints in agricultural production. Women do not have adequate access to agricultural information and innovations (Saito and Surling, 1993). Folasade (1991) emphasized that lack of separate land for women and inadequate contact with extension agents are serious constraints faced by women farmers. Women very rarely own land in Nigeria, despite their heavy involvement in agriculture. Because women generally do not own land or other assets it has traditionally been difficult for women to obtain bank loans or other forms of credit through the banking system. Land tenure system is largely by inheritance. This lack of title to land, according to Famoriyo (1979), prevents women from exercising or improving their expertise in crop

production and animal husbandry because of security of tenure. Majority of them use low yielding and unimproved planting materials, primitive and labour intensive farm implements, traditional farming practices, which have adversely affected agricultural production.

1.2 Problem Statement

Although Nigeria is naturally endowed with rich agricultural land areas and water resources in which the wetland environments and the inland valleys are regarded as having the highest potential for intensification in rice production, ironically, she has not been able to produce enough rice for the domestic need of the teeming population. Hence, the gap between rice demand and domestic supply has further been widened over decades among households across the length and breath of the country. This has culminated in a situation whereby domestic supply has been complemented with enormous rice import in consequence of which Nigeria has emerged a major importer of rice in the West African sub-region (Saka *et al.*, 2005). Currently, Nigeria is the world's second largest importer, importing 2 million tons of rice worth ₦365 billion annually (FMARD, 2011a).

In response to the prevailing rice supply deficit situation in the country, successive Nigerian government have intervened in the rice sub-sector by increasing tariff on rice importation so that local production could be encouraged in order to widen the home market for the nation local rice (Badawi, 2004). Towards this direction, the Federal Government of Nigeria in collaboration with the States and Local Government Areas in the past have established research institutes and launched various projects, programs and schemes aimed at increasing local rice production. Among these are the Federal Rice Research Station (FRRS) in 1970s, the National Cereal Research Institute (NCRI), Badegi in 1974, Operation Feed the Nation (OFN) in 1976, River Basin Development Authority (RBDA) in 1977 and the Agricultural Development Projects (ADPs) in 1975. Others includes Fadama II and III projects, NERICA and SAWAH Rice projects all aimed at improving the use of recommended practices in rice production among farmers particularly women in order to meet up with the increasing demand for rice in the country (Imolehin and Wada, 2010).

Thus, in view of the role played by women in rice production in order to bridge the existing gap between demand and supply of rice in Nasarawa State, the State Government has made several efforts through the NERICA rice project and Nasarawa State Agricultural Development Project in collaboration with the State Ministry of Agriculture in disseminating rice production packages aimed at improving rice production in the State. However, Nasarawa State Agricultural Development Programme (NSADP, 2010) reported that rice production packages are often rejected by women rice farmers in the State due to high cost of adoption, lack of accessibility and complexity of some of the rice production packages disseminated to the farmers. These factors also serve as an impediment to the adoption of recommended rice production

packages by women rice farmers in western zone of Nasarawa State. Furthermore, FMARD (2011b) identified inappropriate technology, inadequate new varieties, limited awareness on the use of improved seed, coupled with poor distribution channels, poor seed quality, and adulteration of seed as major constraints in the rice subsector. Despite the significant role of women in rice production in Nasarawa State, studies carried out to examine the factors influencing adoption of recommended rice production practices is inadequate. Also, data on how recommended rice production practices are being adopted by farmers in Nigeria is very scanty.

It is therefore, very imperative to conduct periodic/timely evaluation of the factors influencing the adoption of the recommended rice production practices by women farmers in western zone of Nasarawa State in order to justify the efforts made by the State and the local government areas towards boosting rice production. In view of the above, this research seeks to address the following questions:

- i. What are the socio-economic characteristics of the women rice farmers in the study area?
- ii. What is the level of awareness and adoption of recommended rice production practices among women farmers?
- iii. What is the level of adoption of recommended rice production practices among women rice farmers?
- iv. What are the factors influencing the adoption of recommended rice production practices among women rice farmers?
- v. What are the effects of adopting recommended rice production practices on the yield and income of women rice famers?
- vi. What are the constraints facing the women farmers in the adoption of the recommended rice production practices?

1.3 Objectives of the Study

The broad objective of the study is to assess the factors influencing adoption of recommended rice production practices by women farmers in western zone of Nasarawa State. The specific objectives of the study are to:

- i. describe the socio-economic characteristics of women rice farmers;
- ii. ascertain the level of awareness of the recommended rice production practices among women rice farmers;
- iii. ascertain the level of adoption of recommended rice production practices among women farmers;
- iv. determine the factors influencing the adoption of recommended rice production practices among women rice farmers;
- v. determine the effect of adopting recommended rice production practices on rice yield and income of women farmers, and
- vi. identify the constraints faced by women farmers in rice production in the study area.

1.4 Justification of the Study

In Nasarawa State, current data related to rice production practices are very scanty and in some instances not available. Hence, in an attempt to improve on the food security situation in the area of rice production in the State and to reduce the high burden on rice importation, this study will be very useful in providing a baseline data in respect to the role of women in rice production in western zone of the State. Thus, apart from addition to the existing knowledge and literature with respect to the role of women rice farmers in western zone of Nasarawa State, it will also serve as a pivot for further research in the study of factors influencing adoption of recommended rice production practices.

To the research institutes, Agricultural Development Projects and Nasarawa State Ministry of Agriculture, this study will help in developing strategies that will improve the adoption of rice production technology among women farmers in the study area. In addition to the above, the findings of the study will equally help both the federal, states and local government areas to come up with appropriate policies that will help in improving rice production in the country to avert the problems of food insecurity.

1.5 Hypotheses of the Study

In the course of the research, the following hypotheses will be tested:

- i. There is no significant relationship between women rice farmers' socio-economic characteristics and the adoption of RRPPs.
- ii. There is no significant relationship between institutional variables and adoption of recommended rice production practices.
- iii. There is no significant relationship between technological attributes and adoption of recommended rice production practices.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Previous Studies on Socio-Economic Characteristics of Women Rice Farmers

In many African countries most especially in sub-saharan Africa, women constitute the primary source of labour force on small scale farms. As practicing farmers, they play major roles in Tillage, sowing, weeding, fertilizer application, harvesting, processing, transporting and marketing of agricultural produce/products (FAO, 2001). In Nigeria, and most of the sub-saharan African countries, women provide about 56% of the labour force required in rice production, either as family or hired labour (Akande, 2000). Ogunbameru and Pandey (1998), also reported that women produce about 60-80% of the agricultural foods in Nigeria and constitutes about 60% of the farming population and are also responsible for about 70% of the actual farm work. Similarly, Helen (2007), observed that many women farmers in Nigeria function as independent farmers as well as family farm labourers. The independent farmers constitute mainly of widows who are responsible for their families.

Akpokodje *et al.* (2001) stated that women rice farmers in Nigeria are mostly landless, but obtain their land for rice cultivation through land leasing or borrowing from family members, friends, children or communal land. Majority of the women rice farmers in Nigeria are less educated with most of them being primary or secondary school leavers. The age group of these women is also an important socio-economic variable which influences their productivity. This is because young women farmers have more tendency of being progressive and hence are willing to adopt new rice production practices than older ones thereby leading to higher technical efficiency in rice production. In addition Akpokodje *et al.* (2001) also unveils that most women rice farmers in Nigeria fall within the age range of 45-55 years which may vary also from one location to another.

Ekong (2003), also observed that the traditional land tenure system in Nigeria has denied women access to land ownership rights or title. The absent of women's land rights is responsible for their inability to use land as collateral security to enable them obtain loan from credit or financial institutions in the country in order to boost their productivity. Therefore, most of them depend on credit from friends or relations and cooperatives to finance their rice production projects.

The annual reports from Rice Farmers Association of Nigeria (RIFAN, 2006), indicated that Women Rice Farmers can be described as an indispensable group of the Nation in view of their contribution to rice production in the country. However, most of them are small scale farmers due to their low propensity of having access to capital to finance

their rice production enterprises. Hence, most of them cannot cultivate more than a hectare of rice in Nigeria due to poverty and low access to farm inputs. This has also constitute a reason why the average yield/ha of women rice farmers usually fall below 1.5 tones/ha in Nigeria. Thus, because of their average low yields in rice production, most of the women rice farmers participate in their income generating activities like rice processing, marketing of agricultural produce, petty trading and rearing of smaller ruminants or poultry keeping to complement their income in order to sponsor their children's education and to fulfill other marital responsibilities as women.

Nkonyo and Davis (2008), observed that women rice farmers in Nigeria are predominantly found in most of the States occupying the middle belt to southern parts of the country, most especially in the rice producing States like Kaduna, Niger, Kebbi, Kogi, Nasarawa, Enugu, Benue, Taraba, Kwara, Edo, Ondo, Ogun and Cross River states of Nigeria. Most of these women do not belong to any of the recognized national farmers' association but may belong to local women associations which are affiliated to tribal or based on their religious denominations. The tribal or religious associations where these women farmers belongs to also constitute a major source of credit to finance their income generating activities. Thus, in Kaduna, Niger and Nasarawa states, these local women associations constitute a major source of communal labour force to their members when the need arises during rice cultivation seasons. In some cases, these women constitutes a major source of hired labour for large scale famers where youths are not easily mobilized or when the task is gender bias.

2.2 Women Farmers Awareness of Recommended Rice Production Practices

Previous research reveals that access to information on improved packages/technologies on rice production by women rice farmers are very limited. In other words, women have little or no access to the benefits of research and information (Emmanuel, 2004). FAO (1999) also reported that availability of agricultural information on innovations always lead to high level of farmers' awareness about the introduction and the benefits of adopting a particular agricultural innovation. This could also translate into high level of adoption of such production technology. Fashola *et al.* (2006), reports that awareness could lead to adoption but does not necessarily results in adoption. This is because adoption of agricultural innovations depends on credibility of the source of information, knowledge, level of awareness, farmers attitude and group influence which may also affect adoption behavior.

Jibowo (2000), defined awareness as the extent to which information on a particular agricultural innovation is known to the farmers. Farmers awareness on the usage of a particular agricultural innovation may arose the interest of the farmer, after which he will develop interest to find out the relative advantage of such innovations from neighboring farmers or extension agents. Agricultural innovations that are feasible, easier and cheaper to be adopted always win the farmers' interest immediately after the awareness stage. But those innovations that are complex and expensive even though

there could be relative advantage are always rejected by most farmers at the awareness stage. For instance modern rice processing techniques has relative advantage to women rice farmers but the machineries are very expensive to purchase and maintain. Women rice farmers' awareness on recommended rice production practices may also depend on their literacy level, membership of cooperative associations, cosmopolitaness and level of patronage by extension agents to disseminate rice production packages to the target group (WARDA, 2007).

2.3 Factors Influencing Adoption of Recommendation Rice Production Practices

Available literature has revealeds that new technologies increase efficiency, but women rice farmers have limited access to information on rice production technology in Tropical Africa countries (FAO, 2006). Evidence from literature also suggests that the rate of adoption of rice production and processing technologies by women farmers in West African countries has stagnated despite the importance of rice in the daily diet of the farm households and urban families. In other words, rice production technologies in recent times appears not to have generated better yields due to low adoption of improved rice production technologies (FAO, 2004).

Oladebo (2003), observed that lack of access to capital serves as a major constraint on women adoption of recommended agricultural technologies. This is because most rural women rely on the use of traditional technologies and tools for their production and processing operations simply because such technologies are at women farmers' disposal. Spore (2003), attributed the low adoption of improved rice recommended technology to lack of initial agricultural production capital, which acts as a barrier to women rice farmers and also limits their means of hired labour or affording available technology. This could also affect their ability to purchase fertilizers and acquire equipment which hamper their ability to improve and expand their rice productivity.

Food and Agriculture Organization (FAO) (2006), have identified some barriers which are associated with low adoption of improve rice production technologies by women farmers. This includes: large investment cost, perceive risk associated with new technology, long gestation period for the benefit of the technology to materialize, poor access to information and extension services, land tenure, culture and recent history. The socio-economic status of women farmers such as marital status, family income, education level, occupation and social status also affect technology adoption. For instance in Kenya, some of the socio-economic factors reported as constraints to technology adoption includes high initial investment cost, negative image and limited private sector involvement (Demarest *et al.*, 1993).

Fonjong (2002), equally observed that a wide range of economic, social, physical and technological aspects of farming has influence on the adoption of agricultural technologies. These range of factors that affect farmers adoption behavior includes demographic variables, characteristics of the technologies, information sources, farmer's knowledge, awareness, years of farming experience, attitude and group influence. However, socio-economic conditions of the farmer are the most cited factors influencing technology adoption. The variables most commonly included in this category are age, education, household size, land holdings and other factors that indicates the wealth status of the farmer. For example, women farmers with bigger land holdings in Tanzania, Kenya and Ethiopia were having the ability to purchase improved rice production and processing technologies but their final decision also depends on institutional factors. For instance, the introduction of a new rice production technology creates demand for information useful in making decisions. Access to such sources of information can be crucial in the adoption of such technologies. Hence, the agency that is responsible in supplying such information must be credible enough to exert farmers' awareness and arouse their interest. In this case their previous records are very important in influencing farmers decisions (Tabi *et al.*, 2010; Saka and Lawal, 2009).

However, Bangura (1993), argued that the best predictor of adoption was the farmers' individual goals. Although, if there are differences in the goals of technology and the farmers' goal, achieving success by the farmers in the use of innovation will only be a mirage. The farmer's socio-economic status can also pose a threat to his/her farming activities. The characteristics of an innovation can also create a problem for the farmers. Innovations that are simple and relatively easy to understand are more likely to be adopted by the farmers than those that are complex. Hence, farmers prefer to adopt innovations that satisfied their security needs, less complicated, required less time to use and are less labour-demanding. Such innovations are easily communicated within a short-time to intending users/farmers.

Kumar and Popat (2010), noted that farmers' characteristics such as knowledge, market orientation and innovativeness influences adoption gap significantly. Lack of knowledge about an innovation can limit adoption. On the other hand, attitude, knowledge, skills and the personality of the extension agents can also be a constraint to the use of an innovation. Drechsel *et al.* (2010), equally observed that scientists have often been criticized for lacking the skills necessary for implementing their innovations. Likewise, lack of technical know-how on the use of technology by farmers can be a serious constraint to the adoption and success of an innovation. For instance the adoption of SAWAH rice production package by women farmers has been constrained by some components of the package like bunds construction, puddling, flooding and flood control, leveling and smoothening, dyke construction, canal construction, seed selection, transplanting, fertilizer application, use of sand bags, water management, weed management, disease and pest management, and nursery preparation.

In another development Saito *et al.* (2012) asserts that despite the significant role of women farmers in third world countries, most especially in rice production, their level of productivity is constrained because the technologies are mostly been designed on the assumptions that farmers are all men. This also gave rise to several other constraints to women farmers like failure of extension workers to reach them, limited access to credit by women farmers, lack of access to relevant technical information and lack of incentive to increase rice production. In the same vein, legal social and institutional factors also serve as barriers for women farmers to adopt improve rice production technology. As a result, most women have less access for higher effective costs for land, information technology, inputs and credit (Kumar, 2000).

2.4 Empirical Studies on the Effects of Adoption of Recommended Rice Production Practices

Improve Agricultural technologies have been widely recognized as a prime factor for increased rice productivity as well as an engine for accelerating rural economic growth (FAO, 2000). Towards this direction, Kumar (2000), states that the impact of increased productivity of rice by women farmers enable them to provide enough food for their families. Hence, new techniques leads to increase the value and economic income from rice production. Similarly, Sita and Ponnarasi (2009) disclosed that the adoption of improved rice varieties by women farmers in addition to the above has increased their cash/income to meet family food requirements and for the purchase of vital goods for the family.

An empirical study was also conducted by Saka *et al.* (2010) to determine the effect of adoption of improved rice production packages among small scale women farmers in South Western Nigeria. The reports from the research shows that women farmers have responded appreciable to the SAWAH rice programme intervention with an adoption rate of 68.7%. The mean yield of the SAWAH improve rice production package (1601t/ha) was significantly higher than the yield of the local rice varieties (1.154t/ha with a yield advantage of 38.7%. The study also reveals that ITA-150 and OfadaWere the most prominent improved local varieties of rice respectively. However, the mean yield (1.586t/ha) for Paddy rice in the area is still considerably low indicating that the improved rice technology is yet to have an appreciable impact on the level of productivity. Although, the improved rice production technology was estimated to have led to a 19.4% proportional production increase in rice production in the area.

Kaduna State Agricultural Development Project (KADP, 2011) conducted an evaluation study based on cost and return analysis on rice production among women rice farmers in Kajuru Local Government Area of Kaduna state. The report from the study reveals that cost and return analysis of Nerica (8) rice variety per hectare, recorded an average of 2.6 ton/ha at ₦85,000/ton. The generated revenue was ₦221,000 Naira/ha from a total expenditure of ₦132,000 Naira. The Gross margin analysis/ha using NERICA (8) rice variety recorded ₦89,000. Similarly, the Gross Margin analysis of indigenous

upland variety was computed at an average yield of 2.0 ton/ha at ₦85,000/ton. The total revenue obtainable per hectare was ₦170,000 from a total expenditure of ₦112/ha. The Gross Margin analysis using the indigenous upland variety recorded ₦58,000. The difference in income from the calculated Gross Margin analysis shows that the use of improved rice production technology give better yield/ha. Likewise the income generated differs with about ₦31,000 Naira/ha.

Bello (2011), also noted that the adoption of NERICA rice production technology has advantage to small scale rice farmers in Kaduna state over the use of the existing Fadama local rice varieties. This is because the cost and return analysis of NERICA rice and Fadama local rice variety shows that an average total variable cost of ₦ 68,184/ha and ₦46,740 was incurred for NERICA rice and Fadama local rice production respectively. The total average output for NERICA rice and Fadama local rice were 2,509.11kg/ha and 2,001.09 Kg/ha respectively.

The unit price of output per 1kg of NERICA Paddy rice was ₦85 and that of Local Fadama Paddy rice was ₦60. This means gross income for NERICA rice was ₦213,274.35/ha and that for local Fadama Paddy rice was ₦120,065.40/ha. The gross margin for NERICA rice production enterprise per hectare was ₦145,090.35/ha and that for Fadama local rice Paddy was ₦73,325.40/ha. The returns per Naira invested in NERICA rice production was ₦2.13k while the return per naira invested for the local Fadama paddy was ₦1.57k. Hence, the adoption of NERICA rice production Technology by farmers gave more turns for every Naira invested than the use of local Fadama paddy. This result also agreed with the findings of Okech *et al.* (2009) on the comparative economic analysis of traditional and improved upland NERICA rice varieties in Kisumu district of Kenya. The results from the research found that the gross margin obtainable by farmers from adopting NERICA improved rice production technology was 95.005 Shillings per hectare (₦183,015.16/h) with a net gain of 3 shillings for every one shilling invested (that is ₦5.8k for every one Naira invested). Likewise, the gross margin obtained from the use of local variety was 63,647 shillings per hectare (₦122,606.93/ha) with a net gain of 2 shillings for every one shilling invested (that is ₦3.9k for every one Naira invested). In addition to the above, Kudi *et al.* (2010), on comparative analysis of profitability of NERICA rice production technology and local rice varieties in Chikun Local Government area of Kaduna State found that the average gross margin obtainable by farmers from the adoption of NERICA rice production Technology was ₦234,641.90/ha with a net gain of ₦2.01k for every one Naira invested while the average gross margin from the local rice variety obtainable by the farmers was ₦91,969.60/ha, with a net gain of 80k per naira invested. This implies that rice production enterprise using local variety is not solvent.

2.5 Rice Production Constraints in Nigeria

Akande (2000), reported that rice is cultivated in virtually all the Agro-ecological zones in Nigeria. However available statistics on rice production has revealed that the area of

land devoted to rice cultivation is still very small compared to other cereals crops like maize. This is because out of the 25 million hectares of land cultivated to various food crops, only about 6.37% of the 25 million hectares is devoted to rice cultivation with an average yield of 1.47 tons per hectare. The low level of risk production in the country is associated with poor technology used in rice production and processing. This problem constitutes major constraint facing women rice production farmers in Nigeria.

Rice Farmers Association of Nigeria (RIFAN, 2006), stated that there are varieties of factors that serves as constraints to rice production among women farmers in Nigeria. These include, poor producer price, lack of farm inputs subsidy, problems of borrowed technology, draught incidence in some part of the country, land tenure problems, lack of rice irrigation dams and lack of modern rice production and processing facilities among others.

West African Rice Development Association (WARDA, 2007) stated that, apart from the latest New Rice for Africa (NERICA), over 50 varieties of rice have been developed with a variety or more suited for each of the six geo-ecological zones of Nigeria. Yet, the rice production level is not encouraging due to lack of farmers access to improve production technologies, poor capital base and the drudgery nature of rice production using rudimentary technology.

According to Singh *et al.* (1997), rice production in Nigeria is carried out in upland and swamp ecosystems of the country. The upland rice production accounts for about 30-35% of the total rice area in the country with an average yield between 0.8-2.0 tones/ha. The swamp rice production system also accounts for 25% of total land area in Nigeria with an average yield of 2-8 tones/ha which also accounts for about 43% of the national rice production. The average low yield obtained by famers in rice production per hectare is as a result of high dependence on the use of local variety for rice production, lack of subsidy in rice production inputs and lack of farmers access to improve rice production technologies among others constitutes major constraints in rice production in Nigeria.

West Africa Rice Development Agency (2007) disclosed that Kaduna state is the leading producer of the national rice with about 22% of the total domestic rice production, followed by Niger with 16% contribution to the total domestic rice production, followed by Taraba and Nasarawa States with 10% contribution to the total domestic rice production. This implies that Kaduna state alone account for a total annual production of about 600,000 tones of cultivated rice in about 240,000 hectares of land. This 22% of the total national production contribution by Kaduna state can also be translated to an estimated annual turnover of about ₦48 billion followed by Niger state, with ₦42 billion with Taraba and Nasarawa State with ₦23 billion Naira each. But the bulk of the actual rice farming population in these states are mostly small scale. Majority of these farmers are engaged in upland rain-fed rice production system which they claim is less hectic compared to the lowland ecology but it is associated with low yield on the other hand, the lowland ecology rice production gives better yield, but most

of the farmers especially in the Northern parts of the country are constrained by lack of access to fadama wetland for rice production.

In Nigeria, several opportunities exist for investors in the three components of the rice industry in Nigeria since the demand for rice is increasing on a daily basis. These three components of the rice industry includes production, processing and marketing. For instance, the private sector organization like Veetee Rice, Olan Rice and Dangote Group of Companies are making impact in rice production, processing and marketing in Nigeria. In spite of the recent positive development in rice production, the crop is still predominantly produced by small scale holders. Based on this record in the mid 90s, the average, rice producing-households do harvest 4.6 tons of paddy per year from a cropping land area of 3.3 hectares, corresponding with an overall average yield of 1.8 tons of paddy per hectare projection. Thus, from 2005 up to 2011. The status of rice production in most of the northern states including Nasarawa State recorded little or no increment due to poor government policy on rice production which also serve as a major constraint to the farmers in the area of rice production. The poor government policy in rice production is also responsible for the poor producer price of the locally produced rice by women farmers (WARDA, 2007).

2.6 The Concept of Technology

The concept of Technology is derived from the Greek word “techne” meaning art or craft. Today, the concept of technology has been used to mean ways of making/producing or doing things. Technology therefore aims at getting things done and done efficiently.

Norabhoomppat (1998), defined technology “as the application of knowledge for practical purpose that will be used to improve the condition of human and natural environment. Omotayo (2005), also defined Technology as the knowledge which we possess concerning ways of doing things i.e. how we design, produce, distribute or sell goods as well as services to satisfy people needs.

The basic reason for the adoption of agricultural technologies is that, it helps to reduce monotony of work, drudgery and increase productivity. In other words, technology adoption is the assimilation of new ideas, methods, practices, techniques, cultural tools, equipment or machinery that could provide higher efficiency in production (Bolorunduro, 2005; Bolorunduro and Adesehinwa, 2007). Under Agricultural domain, technologies also play a vital role in improving farmers’ productivity. However, technologies that do not fit into a particular farm’s condition or needs are usually rejected. In some instances, farmers do reject technologies not because they are conservative or ignorant but because they rationally weigh the changes in incomes and the risks associated with such technologies under their natural and economic circumstances. Although, poor transfer of information between research and extension

has been postulated as being responsible for non-adoption of improved technologies by the farmers.

In Agriculture, technology can be grouped into two namely; indigenous and improved/modern technologies. Indigenous technologies are those technologies generated at the farm level by the farmers which are adaptable to their farming practices. On the other hand, modern/improved technologies are those technologies that have been developed largely by improving or refining the indigenous technologies and are often very important technologies generated from research institutions.

Hence, it is of paramount important to note that, the transfer and adoption of improved practices/innovations to the predominantly farming populace of this country is one of the greatest challenges facing agricultural scientists and extension service workers in Nigeria. Since, many of these technologies reach the farmers but only few are eventually adopted with many discontinued due to incompatibility tendencies (Ekong, 2003).

2.7 Theoretical Framework

This study is guided by adoption and diffusion theory. Adoption is regarded as a decision to make full use of an innovation or technology. Adoption is the mental process through which an individual passes from first knowledge of an innovation to a decision as whether to adopt or reject, and later confirmation of his decision (Jibowo, 2005). Onuoha and Nnadi, (2006), defined diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system.

Cruz (1978) cited by Mosher (1987) defined that adoption of an innovation is the process by which a particular farmer is exposed to, considers, and finally rejects or practices a particular innovation. The innovation decision model by Rogers (1995) shows the process through which an individual (or other decision making unit) passes from first knowledge of an innovation to forming an attitude towards the innovation, to a decision to adopt or reject, to implement of the new idea, and to confirmation of this decision.

2.8 The Conceptual Model

A model is simply “an attempt of classifying the major elements of an entity or a phenomena with regards to their function and interrelationships in order to observe more closely how the elements function within the entity or how they act upon one another”. The interrelationship that exists between the elements in a model can be depicted schematically or mathematically (Asika, 2001).

Thus, in developing the model for this research, an attempt was made to integrate the theories and findings of some experts. These include those of Jibowo (2005); Ekong (2003) and Onuoha and Nnadi (2006). Emphasis in the model is placed on the influence of socio-economic characteristics of women rice farmers and institutional variables on the adoption of recommended rice production technologies in western zone of Nasarawa State. Hence, the conceptual model of the study posits that the adoption of recommended rice production practices among women farmers will lead to increase in output and income of women rice farmers in the study area. The conceptual model is illustrated in Figure 2.1.

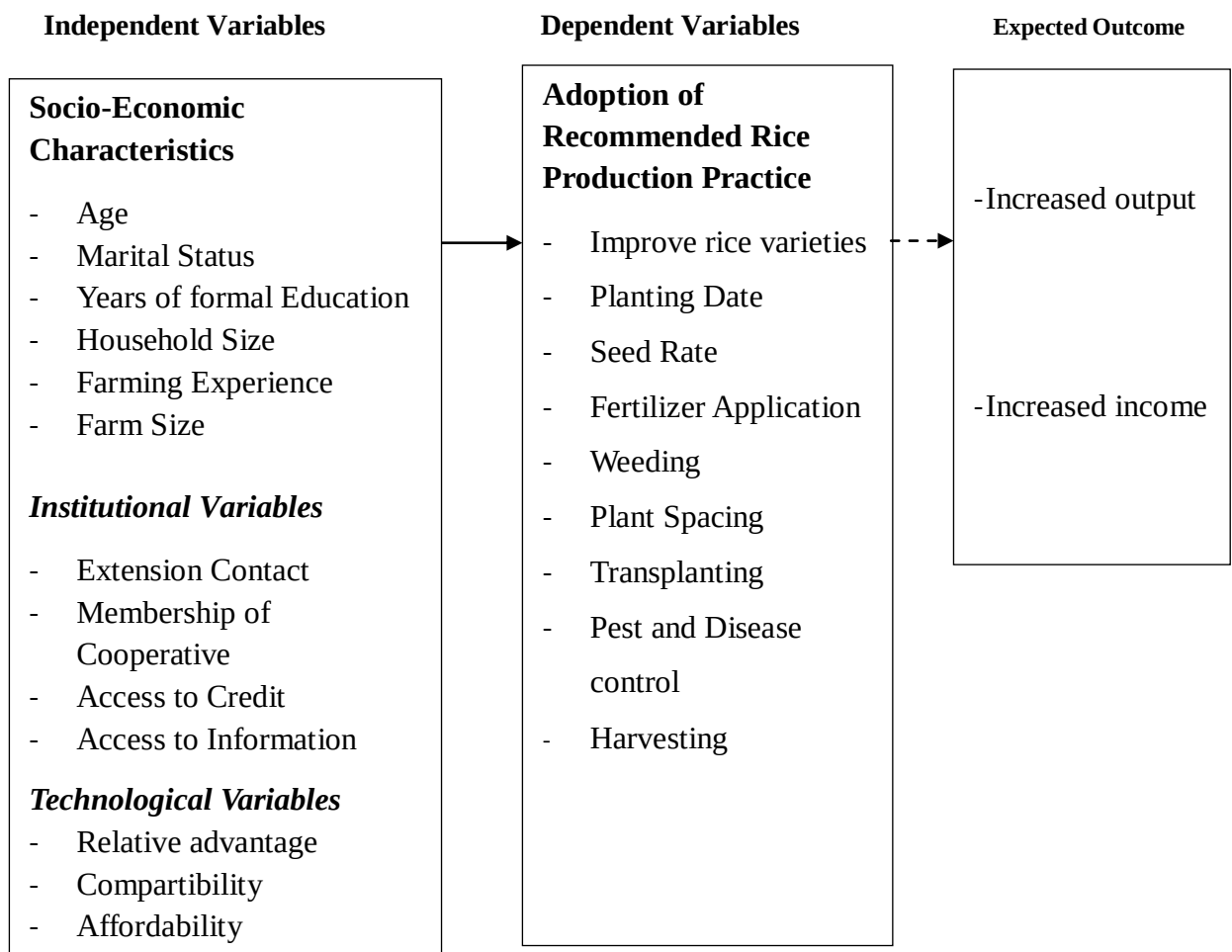


Figure 1: A model of factors influencing the adoption of RRPPs among women farmers in the study area

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

This study was carried out in western zone of Nasarawa State. Nasarawa State is bounded in the north by Kaduna State, in the west by the Federal Capital Territory (Abuja), in the south by Kogi and Benue States and in the east by Taraba and Plateau States. The State is located in Southern Guinea Savanna belt of the country and occupies a total land area of 28,682 square kilometers with a population of 1,869,377 (NPC, 2006) and a projected population of 2,392,803 by the year 2014 using the national annual growth rate of 3.5%. The western zone comprise of five local government areas: Karu, Keffi, Kokona, Nasarawa, and Toto.

The climate within Nasarawa State is typically the tropical type with two distinct seasons; that is the dry and rainy seasons. The rainy season starts from the month of April to October, while the dry season falls between November to March (Collins, 2009). The average annual rainfall within the State is 1,300mm/annum while the temperature is within the range of 23°C - 28°C (Collins, 2009). Nasarawa State has agriculture as the mainstay of its economy with the production of varieties of cash crops throughout the year. The State is predominantly agrarian with majority of the population actively involved in farming. The major ethnic groups in Nasarawa State include Eggon, Tiv, Alago, Hausa, Fulani, Mada, Rindre, Gwandara, Koro, Gbagyi, Ebira, Agatu, Bassa, Aho, Ake, Mama, Arum and Kanuri. Likewise, the women from these ethnic groups are the major rice producers in the state. Other food crops produced within the study area apart from rice include yam, beniseed, sorghum, melon, cassava, cowpea and maize (NASADP, 2008). The selected Local Government Area used for the study area is depicted in Figure 3.1.

Rice occupies a dominant position among arable crops grown in the Western Agricultural Zone of Nasarawa State. Farmers in the zone cultivate rice as sole crop in the field and or as intercrop with others such as maize and cocoyam. Nasarawa State is one of the major rice producing areas in Nigeria where production capacity was estimated at 655,000 metric tons/ha from 2003-2008 (NADP, 2010). Between 2007 and 2014, an estimated land area of 642.16 ha produced an estimated 1,449,000 metric tonnes of rice as indicated in Table 3.1.

Table 3.1: Land area cultivated and production estimates for rice in Nasarawa State

Year	2007	2008	2009	2010	2011	2012	2013	2014
Land Area Cultivated (Ha)	44.7	46.04	53.71	54.78	80.33	103.4	124.4	134.8
Production ('000MT)	98.41	100.39	137.66	139.04	184.896	185.02	285.5	318.6

Source: NAERLS Agricultural Performance Survey of Wet Season 2007 – 2014.

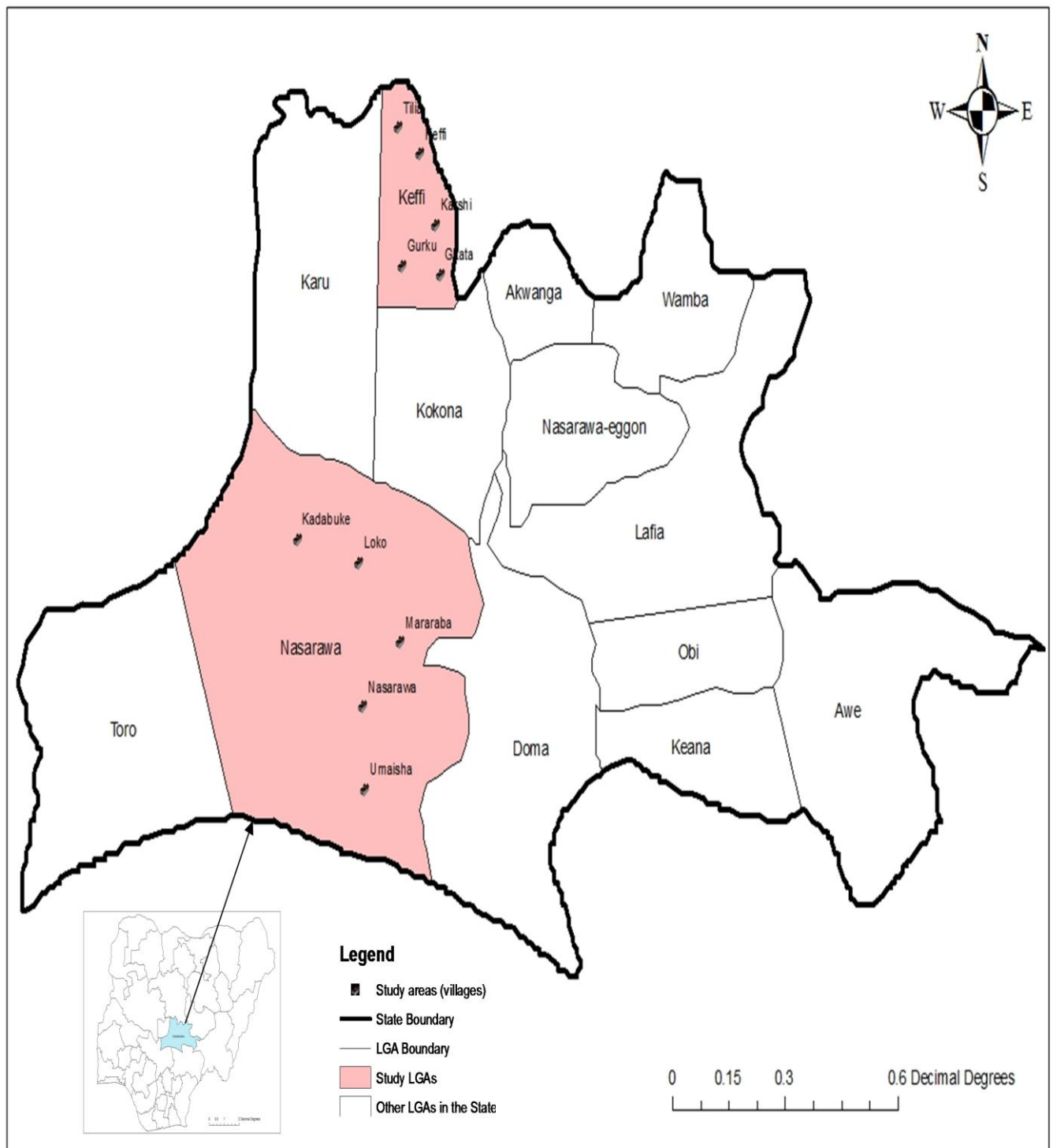


Figure 3.1: Map of Nasarawa State showing the study area

3.2 Sampling Procedure and Sample Size

The population under study constitutes mainly women who are involved in rice production in western zone of Nasarawa State. A multi-stage sampling technique was used to select the women rice farmers for this study. The first stage was the purposive selection of two LGAs from the zone. This selection was based on the prominence of rice production as well as the predominance of women's involvement. The second stage was a purposive selection of five major rice-producing villages in each Local Government Area. The third stage was the random selection of women rice farmers in the selected villages. Ten percent of the women rice farmers were selected per village as shown in Table 3.1. In all, a total of 203 women rice farmers were used for this study. The sample distribution of women rice farmers showing the projected total population of women rice farmers in the year 2014 and the 10% sample size selected is illustrated in Table 3.1.

Table 3.2: Proportionate sample distribution of women rice farmers

LGAs	Selected Villages	Sample frame	10% Sample
Nasarawa	Kadabuke	241	24
	Loko	234	23
	Mararaba-Odeke	192	19
	Nasarawa	238	24
	Umaisha	167	17
		198	20
Keffi	Gitata		
	Gurku	148	15
	Karshi	182	18
	Keffi	253	25
	Tilla	179	18
Total		2,032	203

3.3 Methods of Data Collection

Primary data were used for this study. The primary data were collected through the use of structured interview schedule which was administered to two hundred and three (203) women rice farmers from the ten selected villages in the two Local Government Areas under study. Enumerator were used to administer the interview schedule on the farmers. Women rice farmers were visited to collect relevant data. Secondary sources such as reports of ADPs, published materials like textbooks and journals as well as the internet were utilized for this study.

3.4 Analytical Techniques

Descriptive statistics were employed to describe the socio-economic characteristics and institutional variables of women rice farmers, the level of awareness of recommended rice production practices, the level of adoption of RRPPs, and the constraints facing women rice farmers in the study area. This includes the use of frequency counts, percentages, mean scores and ranking. For objective iv, that was to determine the factors influencing the level of adoption of recommended rice production practices by women farmers; the multiple regression model was used. Multiple regression was also used to test the hypotheses.

The multiple regression model is expressed as:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \dots b_{11}X_{11} + U$$

Where:

Y = Adoption of recommended rice production practices (measured in numbers)

a = Constant

X₁ = Age of women rice farmers (in years)

X₂ = Marital status (Married = 3, Single = 2 or widow = 1)

X₃ = Years of formal Education (in years)

X₄ = Household size (number)

X₅ = Farming experience (in years)

X₆ = Farm size (ha)

X₇ = Extension contact (number)

X₈ = Membership of cooperative societies (Number)

X₉ = Amount of credit received (₦)

X₁₀ = Access to Information (Number of sources)

X₁₁ = Relative advantage (Perception)

X₁₂ = Compatibility (Perception)

X₁₃ = Affordability (Perception)

X₁₄ = Complexity (Perception)

U = Error term

3.5 Independent Variables and their Measurement

- i. **Age:** This refers to the actual age of the women rice farmers at the time of data collection in the field. Age was measured in years.
- ii. **Marital Status:** Is the marital status of the women rice farmers at the time of data collection in the field i.e. married = 3; singles = 2; widow = 1.
- iii. **Level of Education:** It was measured as the number of years the women rice farmers spent in acquiring western education.
- iv. **Household Size:** This is the number of children and dependents under the care of the women rice farmers at the time of visit. It was measured in number.
- v. **Farming experience:** This is the total number of years the women rice farmers had being in rice production business. It was measured in years.
- vi. **Farm size:** This refers to the number of hectares devoted/under cultivation by a woman rice farmer at the time of visit. It was measured in hectares (ha).
- vii. **Extension contact:** This is the frequency of contact of the women rice farmers with extension agent within a season. It was measured by the total number of visits, training or information received in 2013 – 2014 by women rice farmers on rice production packages in a given season. It was measured in number.
- viii. **Access to credit:** This is the total amount of money received by a women rice farmers from money lending agencies like banks friends relatives, money lenders or government with the aim of purchasing farm inputs for rice production. It was measured as the amount of money received by the women rice farmers in Naira.
- ix. **Membership of cooperative societies:** This is the number of cooperatives associations that women rice farmers belongs to at the time of data collection. It

was measured by the total number of cooperative organizations that each women rice farmer belongs to at the time of the visit.

- x. **Access to information:** This is the extent to which women rice farmers had access to relevant information on rice production. It was measured by the number of information sources available to women rice farmers.
- xi. **Relative advantage:** This is the degree to which respondents perceive RRPPs to be better than the old practices. It was measured by the perception of women rice farmers using the Likert-type scale.
- xii. **Compatibilty:** This is the degree to which respondents percieve the RRPPs to be in line with the prvailing socio-cultural values and beliefs. It was measured by the perception of women rice farmers using the Likert-type scale.
- xiii. **Affordability:** This is the degree to which the respondents can readily pay the cost of RRPPs. It was measured by the perception of women rice farmers using the Likert-type scale.
- xiv. **Complexity:** This is the degree to which respondents perceive the RRPPs to be relatively difficult to use. It was measured by the perception of women rice farmers using the Likert-type scale.

3.6 Dependent Variable and its Measurement

The dependent variables of this study are the recommended rice production practices available to women rice farmers within the study area. Among the recommended rice production package/technologies disseminated to women rice farmers include improved rice varieties, date of planting, intra-spacing, inter-spacing, fertilizer application, weed control, pest control and time of harvesting.

3.6.1 Measurement

The adopted packages were measured as the number of practices a woman rice farmer adopted among the rice production packages and is currently practicing them in rice production. Each practice adopted was scored as one against the technology adopted

and was added up to constitute the total score of each individual women rice farmer sampled for data collection. Thus, adoption of RRPPs (Y) was measured based on number of technologies adopted by women rice farmers in the study area.

Technological variables: A 5-point Likert-type scale was used to measure the perception of women rice farmers on the technological attributes thus: Strongly agreed (5), Agreed (4), Undecided (3), Disagreed (2), Strongly disagreed (1). A maximum score was obtained by summing up the score for each women rice farmers. The percentage score was obtained by multiplying the score by hundred.

3.7 Expected Output

The expected output from the adoption of rice production packages by women rice farmers was measured in yield and increase in income as follows:

- i. **Yield:** This was measured as the total number of bags (100kg) of paddy rice harvested by a woman rice farmer divided by the total hectarages under its production in the year 2014.
- ii. **Farmers' income:** This refers to the total amount of money received from the sale of rice within a cropping season. The women rice farmers were asked to state how much money was realized from the sale of her paddy rice or threshold rice per 100kg bag in 2014.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-economic, Institutional, and Technological Attributes

4.1.1 Socio-economic characteristics of women rice farmers

A number of socio-economic characteristics of women rice farmers were examined. These were age, marital status, level of education, household size, farm size, membership of association, and output. Distribution of the farmers according to their different characteristics is presented in Tables 4.1 to 4.10.

4.1.1.1 *Age of women rice farmers*

Results in Table 4.1 indicate that majority (70.9%) of the women rice farmers were less than 45 years old. This means that women rice farmers in the study area were more than average in terms of age. The implication could be that the acceptance of farm decisions with regards to adoption of improved technologies could be affected negatively. This is in line with the findings of Mustapha *et al.* (2012) who found that majority of rice farmers were within age range of 41-50years old.

Table 4.1: Distribution of women rice farmers according to age (n=203)

Age (Years)	Frequency	Percentage
15 - 24	12	5.9
25 – 34	62	30.5
35 – 44	70	34.5
45 – 54	39	19.2
55 – 64	13	6.4
>64	7	3.5

4.1.1.2 Marital status of women rice farmers

Majority (82.5%) of the women rice farmers were married (Table 4.2). The implication of this was that female farmers have more family challenges to cope with; and this will have resultant effects on their efficiency in rice production. This result agrees with the findings of Onumadu and Osahon (2014) where majority of rice farmers were married. This implied that married people were more in rice farming and this could be as a result of more responsibilities they were saddled with as married people who had the role for providing household needs of their families.

Table 4.2: Distribution of women rice farmers based on marital status (n=203)

Marital Status	Frequency	Percentage
Married	168	82.8
Single	6	2.9
Divorced	5	2.5
Widowed	24	11.8

4.1.1.3 Educational level of women rice farmers

More than 80% of the women rice farmers had below secondary education as indicated in Table 4.3. This was corroborated by Amaza and Tashikalma (2003), that the literacy level of farmers enhances the rate of adoption of improved technology. Education is an essential factor affecting desirable changes in attitude, skills and knowledge of individuals (Unamma *et al.*, 2004). It could be inferred that rice farmers in the study area were literates who could read and write. This could serve as an impetus in adopting

improved rice technologies. According to Akinagbe and Ajayi (2010), education is an important factor influencing adoption of farm innovations.

About 98 % of the rice producers were literate. This result contrast with the findings of Tsega *et al.* (2005) and Khattak and Hussain (2008) who found a high illeteracy level amond rice farmers. Kebbeh *et al.* (2003) also found that about 29 percent of rice farmers in Kaduna and Niger State of Nigeria did not have formal education. These results indicate that rice farmers might have good understanding of improved technologies about rice production, provided they are equally exposed to such technologies. According to Adams (1982) formal education has the potentials for making up some of the deficiency in man; it enhances understanding and communication in agriculture.

Table 4.3: Distribution of women rice farmers by educational level (n=203)

Education	Frequency	Percentage
No Formal Education	21	10.3
Adult Education	68	33.3
Primary Education	79	38.7
Secondary Education	30	14.7
Tertiary Education	5	2.5

4.1.1.4 Women rice farmers' household size

As shown in Table 4.4, 40.2% of the women rice farmers in the study area had household-sizes of between 6 and 9 (Table 4.4). This means that most of the women rice farmers in the study area had a fairly large household size which might serve as an insurance against short fall in supply of farm labour. Household size has a great role to play in family labour provision in agricultural sector. A large household will normally take much of the attention of the women farmer which reflects negatively on her productivity. This result disagrees with the findings of Adebayo (2001) that the size of household affects the output of women rice farmers.

Table 4.4: Distribution of women rice farmers by household size (n=203)

Household Size	Frequency	Percentage
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1 – 5	66	32.4
6 – 9	82	40.2
10 – 15	33	16.2
16 – 19	7	3.4
20 – 25	8	3.9
>25	7	3.4

4.1.1.5 Women rice farmers' years of farming experience

Almost 80% of the women rice farmers had farming experience of between 10 and 29 years and above (Table 4.5). This indicates that the farmers were well experienced in rice farming. This implies that the women rice farmers were widely experienced, matured and could achieve a better understanding of adaptation strategies. The result revealed that the women rice farmers had reasonable years of experience. Asfair and Asefa (2004) reported that there was low level of adoption among older farmers and that was because they have built up ideas and practices over time and found it difficult to change.

Table 4.5: Distribution of women rice farmers according to years of farming experience (n=203)

Years of Farming Experience	Frequency	Percent
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0 – 9	42	20.6
10 – 29	50	24.5
20 – 29	52	25.5
30 – 39	31	15.2
40 – 49	22	10.8
>49	6	2.9

4.1.1.6 Method of land acquisition by women rice farmers

Result in Table 4.6 shows that majority (81.4%) of the women rice farmers inherit their farm lands. This result corroborates the findings of Kolawole *et al.* (2012). This result negates the report of Ajani (2008) that patriarchal structures and authorities give more resources to men in Nigeria, resulting in women having less access to productive resources, particularly land, which is perhaps the most economic constraint for most rural women. Similar to this finding, Fabiyi *et al.* (2007) found that majority of the women farmers in Gombe State acquired land for farming from their husbands and relations (freehold), while others hired land for farming. Land tenure system should be

reviewed in Nigeria. Women also should be made to enjoy land inheritance like men. Since majority of women in rural areas are farmers, land availability for women will bring about increase in food production, self-reliance agricultural development and food security.

In Nigeria culture controls many aspects of the life of women. Famoriyo (1979) stated that land is the vital possession of the people, without land, farming cannot take place. Searching for the way out of poverty, majority of women take to farming, but the constraints limit their performance. As asserted by Oladele and Wakatsuki (2009), the probability of adopting rice technology increases if the plot is acquired through inheritance as it ensures long tenancy period.

Table 4.6: Distribution of women rice farmers based on method of land acquisition* (n=203)

Land Acquisition	Frequency	Percent
Inheritance	166	81.4
Leasehold	42	20.6
Gift	68	33.3
Purchase	33	16.2

*Multiple responses indicated

4.1.1.7 Farm sizes of women rice farmers

Furthermore 75.5% of the women rice farmers cultivate 1 hectare and below as shown in Table 4.7. The result implies that most of the women rice farmers own small sizes of farmland. This may be attributable to the land tenure system prevalent in the study area which encourages small holdings. Saka and Lawal (2009) affirmed that majority of small scale farmers in Nigeria are categorized as having 0.1-3.0 farm holdings. The size of a farm is a strong determinant of the expected output/yield (Nwachuku *et al.*, 2008). Land is the most important aspect in agriculture; without adequate land for food production, this may result to hunger, malnutrition, poverty and death. Inadequate farm land can limit the production capacity of agricultural produce.

Table 4.7: Distribution of women rice farmers according to farm size (n=203)

Farm Size (Ha)	Frequency	Percent
≤1	154	75.5
1.1 - 2.0	13	6.4
2.1 - 3.0	20	9.8
3.1 – 4.0	11	5.4
4.1 - 5.0	5	2.5

4.1.1.8 Women rice farmers' level of income

The results in Table 4.8 showed that only 23% of the women rice farmers had between ₦151, 000 and ₦200,000 annual farm income. This depicts a low level of income among women rice farmers in the study area. This finding is in line with Akpabio (2005) that the poor income level of women farmers could be attributed to the subsistence level of farming prevalent in the rural areas.

Table 4.8: Distribution of women rice farmers by level of income (n=203)

Income (₦)	Frequency	Percent
≤50,000	1	.5
51,000 - 100,000	20	9.8
101,000 - 150,000	42	20.6
151,000 - 200,000	47	23.0
201,000 - 250,000	27	13.2
251,000 - 300,000	22	10.8
>300,000	44	21.6

4.1.2 Institutional characteristics

4.1.2.1 Extension visits to women rice farmers

Majority 51.2% of the women rice farmers were not visited in the previous one year while about 30% of them were visited 1 – 8 times in a year by extension agents (Table 4.9). Technology transfer might not have been adequate since extension visit is regarded as a major vehicle for technology dissemination. Inadequate number of female

extension workers had been identified as one of the major challenges in the State ADPs across Nigeria (NAERLS and FDAE, 2014). Furthermore, this report corroborates the report by NAERLS and FDAE (2014) that the VEA:Farmer ratio in Nasarawa State was 1:1388 and 1:1479 in 2013 and 2014, respectively. Sequel, extension visit to farmers in the State recorded a decline of about 20% within the same period. Also, the number of fourthnightly trainings (FNTs) conducted by Nasarawa State ADP reduced by about 35% while the number of Block Extension Agent (Women in Agriculture) (BEA(WIA)) also reduced by about 7% between 2013 and 2014. Inadequate funding and staffing, inadequate staff training and poor mobility were the major problems of ADPs across the country (NAERLS and FDAE, 2014).

More female extension workers should be trained and sent to help female farmers. It is necessary to particularly identify women as an integral part of the agricultural extension policy and develop gender-specific operational guidelines which will direct the extension activities of women farmers.

Extension visit	Frequency	Percent
0	104	51.2
1 – 8	63	31.0
9 – 16	29	14.3
17 – 24	7	3.4

Table 4.9: Distribution of women rice farmers by frequency of extension visit
4.1.2.2 Women rice farmers' membership of association

Result in Table 4.10 revealed that majority (91.1%) of the women rice farmers belonged to different associations. Also, majority (89.7%) belonged to religious association. This may provide forum for exchange of ideas. Membership of association is of paramount importance in that resources could be pooled together to buy farm machines like the power tiller whose price may not be within the reach of an average farmer. Rahji *et al.* (2009) posited that membership of association is expected to assist farmers to get easy access to credit and other production inputs. Group membership serves as a cohesion that brings them together to exchange ideas and tackle problems common to them.

Table 4.10: Distribution of women rice farmers by membership of association and types

Membership of Association (n=203)	Yes	%	No	%
Belong-association	185	(91.1)	18	(8.9)

Types of Association* (n=185)				
Cooperative-group	82	44.3	103	56.7
Religious-group	166	89.7	19	10.3
Community-based-group	20	10.8	165	89.2
Social-club	20	10.8	165	89.2

*Multiple responses indicated

4.1.2.3 Women rice farmers' access to credit

Result presented in Table 4.11 indicates that informal sources were the major sources used by the women rice farmers. Personal savings and friends/relatives were indicated as the major sources recording a weighted mean of 2.56 and 2.16 respectively. The implication is that even if credits were available in the formal sources (like banks and Government institutions), such credits were not accessible to farmers. Adewuyi and Adebayo (2014) found that only about 5% of female farmers obtained credit facilities in one form or the other. This implies that more women farmers were disadvantaged in securing credits facilities. And this corroborates the findings of Odoh *et al.* (2009) that male farmers have higher access to credit than female farmers due to the ability of male farmers to present collateral in securing loan facilities from banks.

Table 4.11: Distribution of women rice farmers by sources of credit (n=203)

Credit Sources	Weighted Scores				
	VI	I	NI	Weighted Sum	Weighted Mean

Personal savings	24	39	140	520	2.56**
Friends and relatives	22	27	154	438	2.16**
Cooperative	44	37	122	376	1.85*
Input traders	22	67	114	328	1.62*
Government institutions	71	93	39	314	1.55*
Commercial banks	52	69	82	290	1.43*
NGO	141	35	27	274	1.35*
Others	4	17	182	228	1.12*

VI=Very Important; I=Important; NI=Not Important

**Major, *Not major

4.1.2.4 Amount of credit received by women rice farmers

Majority (78.4%) of the women rice farmers received not more than ₦60,000 credit in the last one year (Table 4.12). This means that women rice farmers in the study area were small holder farmers as the amount received limit their capacity to operate optimally. Rahman (2008) found similar result that most farmers receive little or no credit to operate their farms.

Table 4.12: Distribution of women rice farmers by the amount of credit received (n=203)

Credit received (₦)	Frequency	Percent
≤60,000	160	78.4
61,000 - 120,000	11	5.4
121, 000 - 150,000	17	8.3
151,001 - 180,000	8	3.9
181,001 -210,000	7	3.4

4.1.2.5 Women rice farmers' access to information

According to the result shown in Table 4.13, the three most important sources of information indicated by the women rice farmers were ADPs (M=2.12), Cooperatives (M=2.04), and other farmers (M=2.03). This agrees with the finding of Mirani *et al.* (2000) that agricultural extension agents were rated the most satisfactory source of information for the rice production practices studied in Pakistan. Radio (1.89), television (1.65), newspaper (1.42) were rated as not important sources of information by women rice farmers. The low rating of newspaper appears to be reflective of the low level of education of the women rice farmers as reported in Table 4.3.

Table 4.13: Distribution of women rice farmers by sources of information n=203)

Sources of Information	VI	I	NI	Weighted Sum	Weighted Mean
ADPs	66	96	41	431	2.12**
Cooperatives	9	21	173	414	2.04**
Other farmers	42	125	36	412	2.03**
Agricultural show	22	33	148	403	1.99*
Radio	46	118	39	383	1.89*
Television	53	74	76	335	1.65*

Internet	52	28	123	290	1.43*
Newspaper	25	36	142	289	1.42*
Village-head	17	53	133	280	1.38*
Research Institutes	73	54	76	242	1.19*
Others	0	0	203	203	1.00*

VI=Very Important; I=Important; NI=Not Important

**Important, *Not important

4.1.3 Women rice farmers' perception of technological attributes of RRPPs

Result in Table 4.14 presents the summary of women rice farmers; perception of all the technological attributes measured in this study. A total weighted mean average of 2.13 was obtained implying that the overall perception of farmers was high. Perception of relative advantage of the RRPPs recorded the highest weighted mean average of 2.22.

Table 4.14: Distribution of women rice farmers' based on perception of technological attributes of RRPPs (n=203)

Technological Attributes	WS	WSA	WM	WMA	Rank
Relative advantage	4054	450.44	19.97	2.22**	1 st
Compartibility	3857	428.56	19	2.11**	3 rd
Affordability	3966	440.67	19.54	2.17**	2 nd
Complexity	3674	408.22	18.09	2.01**	4 th
Overall WS	15551	1727.89	76.61	8.51	
Overall Perception	3887.75	431.97	19.15	2.13**	

WS= Weighted Sum, WSA=Weighted Sum Average

WM=Weighted Mean WMA=Weighted Mean Average

**High perception

4.1.3.1 Women rice farmers' perception of relative advantage of RRPPs

Results in Table 4.15 indicate that the perception of the relative advantage of RRPPs was high (2.22). This result implies that the RRPPs were superior to the existing practices by farmers and it is consistent with the *a priori* expectation. Production practices must have been subjected to research tests before being introduced to farmers.

Table 4.15: Distribution of women rice farmers based on perception of relative advantage of RRPPs (n=203)

RRPPs	Perception of Relative advantage				Weighted Mean
	Very High	High	Low	Weighted Sum	
Improved varieties	104	82	17	493	2.429**
Planting date	34	127	42	398	1.961*
Seed rate	39	124	40	405	1.995*
Fertilizer application	75	118	10	471	2.320**
Weeding	94	102	7	493	2.429**
Plant spacing	64	104	35	435	2.143**
Transplanting	68	101	34	440	2.167**
Pests and disease control	57	117	29	434	2.138**
Harvesting	85	112	6	485	2.389**
Weighted Mean Average					19.971/9=2.219

**High perception, *Low perception

4.1.3.2 Women rice farmers' Perception of compatibility of RRPPs

The results in Table 4.16 indicate that women rice farmers' perception was high (2.11). Timely weeding was the most compatible practice recording a weighted mean of 2.39. The use of appropriate seed rate (1.96) was not compatible with the existing production practices of the farmers. It is not surprising that seed rate was perceived as not compatible with existing practice of farmers because the traditional calculation has always been casual and based on rough estimate of the size of farmland.

Table 4.16: Distribution of women rice farmers based on perception of compatibility of RRPPs (n=203)

RRPPs	Perception of Compatibility			Weighted Sum	Weighted Mean
	Very High	High	Low		
Use of improved varieties	43	152	8	441	2.172**
Appropriate Planting date	49	112	42	413	2.034**
Appropriate Seed rate	31	133	39	398	1.961*
Fertilizer application	65	116	22	449	2.212**
Timely weeding	84	116	3	487	2.399**

Appropriate Plant spacing	42	112	49	399	1.966*
Transplanting	49	122	32	423	2.084**
Pests and disease control	47	122	34	419	2.064**
Timely harvesting	46	133	24	428	2.108**
WMA					19/9=2.11

**High, *Low

4.1.3.3 Women rice farmers' perception of affordability of RRPPs

Results in Table 4.17 shows that there was high perception of affordability of all the RRPPs except fertilizer application (1.995) by the women rice farmers (WMA=2.17). This might be connected with the high cost of fertilizer as well as the low income level of women rice farmers. This findings corroborates that of NAERLS and NPAFS (2011) who lamented the high cost of input in Nigeria.

Table 4.17: Distribution of women rice farmers based on perception of affordability of RRPPs (n=203)

RRPPs	Perception of Affordability			Weighted Sum	Weighted Mean
	Very High	High	Low		
Improved varieties	21	182	0	427	2.103**
Planting date	38	165	0	444	2.187**
Seed rate	21	182	0	427	2.103**
Fertilizer application	30	124	40	409	1.995*
Weeding	40	163	0	446	2.197**

Plant spacing	34	169	0	440	2.167**
Transplanting	43	160	0	449	2.212**
Pests and disease control	33	170	0	439	2.163**
Harvesting	31	171	0	435	2.143**
WMA					19.536/9=2.171

**High perception, *Low perception

4.1.3.4 Women rice farmers' perception of complexity of RRPPs

Result in Table 4.18 shows the women rice farmers' perception of complexity of the RRPPs. Transplanting (2.17) and the use of appropriate plant spacing (2.16) were perceived as the most complex production practices while planting date (1.74) and use of improved variety (1.75) were the least complex practices. Transplanting is a very tedious exercise in rice production. This finding corroborates the result obtained by Kolawole *et al.* (2012) that some of the production practices are labour-intensive.

Table 4.18: Distribution of women rice farmers based on perception of complexity of RRPPs (n=203)

RRPPs	Perception of Complexity			Weighted Sum	Weighted Mean
	Very High	High	Low		
Improved varieties	21	111	71	356	1.754*
Planting date	24	104	75	355	1.749*
Seed rate	29	155	19	416	2.049**
Fertilizer application	52	111	40	418	2.059**
Weeding	59	105	39	426	2.099**

Plant spacing	70	96	37	439	2.163**
Transplanting	71	97	35	442	2.177**
Pests and disease control	50	117	36	420	2.069**
Harvesting	37	125	41	402	1.980*

**High perception, *Low perception

4.2 Level of Awareness of RRPPs among Women Rice Farmers

Result in Table 4.19 clearly indicates that women rice farmers were aware of all the RRPPs except recommended seed rate and plant spacing. The implication of this finding is that efficient use of land and seeds could have been compromised. Seed rate and planting are closely related as both involve some calculations based on farm size and hence, require practical teaching on the field in order to be perfectly understood by farmers. Therefore, high level of competence on the part of the VEAs is demanded. VEAs are normally trained during the fourthnightly training (FNT) sessions organized by the ADPs. However, there has been a general decline in the number of VEAs and the FNTs conducted by the ADPs in Nigeria (NAERLS and FDAE, 2014). Results presented in Table 4.9 where majority of the women rice farmers were not visited corroborates this finding.

Table 4.19: Distribution of women rice farmers based on level of awareness of RRPPs (n=203)

Recommended practices	Awareness scores				
	Fully Aware	Have Little Awareness	Not Aware	Weighted Sum	Weighted Mean
Timely harvesting	53	150	0	459	2.26**
Fertilizer application	25	158	20	411	2.02**
Timely weeding	32	141	30	408	2.01**
Use of improved varieties	111	89	3	514	2.53**

Pest and disease control	70	104	29	447	2.20**
Transplanting	118	82	3	439	2.16**
Appropriate Planting date	53	122	28	431	2.12**
Appropriate Seed rate	114	82	7	399	1.97*
Appropriate plant spacing	24	135	44	386	1.90*

**Aware, *Not aware

Non-adoption of recommended spacing is tantamount to use of less or more seeds than required for a particular size of land. This situation has its attendant effects on the yield of rice as well as the expected farm income. Non-awareness of appropriate plant spacing could be due to the technicalities involved in passing such knowledge to the farmers. Some extension agents might not themselves possess the required competence to disseminate the message effectively to farmers. NAERLS and FDAE (2014) found low quality of extension agents across the nation's ADPs.

4.3 Level of Adoption of RRPPs among Women Rice Farmers

The level of adoption of various RRPPs is presented in Table 4.20. Harvesting (2.44), fertilizer application (2.29), and weeding (2.20) were the most adopted RRPPs. However, seed rate and planting spacing were yet to be adopted by the farmers. Adoption of recommended seed rate as well as spacing involves calculations based on the land size, variety of seed to be planted, environmental conditions (soil and weather). Also considering the difficult nature of rice production as well as the literacy level of the women farmers, these calculations might be difficult to achieve. Hence, there is the tendency for the women to adopt the easiest method of planting rice which is by broadcasting. This method tends to encourage wastage and poor yield. This position is justified by the previous result on yield where majority of the respondents realized less than 3001kg yield of rice per production cycle. That women rice farmers were not even aware of the recommended seed rate and plant spacing as indicated in Table 4.20 justifies their non-adoption by rice farmers. This result may appear relatively impressive, but this study did not determine the patterns of appropriate technology use by farmers, nor did it isolate all critical production factors.

In a study in Pakistan by Mirani *et al.* (2000) majority of the farmers reported applying an appropriate seed rate, and fertilizer. However, most farmers will rather use the alternative method (broadcasting method) of planting which saves time and rigorous calculation. Mustapha *et al.* (2012) confirmed that majority of rice farmers adopted the broadcasting method of planting rice. Given the great potential for even a single limiting practice having major negative impact on rice production, there appears to be a

need for more dissemination of information on rice production and additional analysis of utilization of approved production technology.

Table 4.20: Distribution of women rice farmers based on level of adoption of RRPPs (n=203)

Recommended practices	Adoption scores				
	Full	Partial	Non	Weighted Sum	Weighted Mean
Timely harvesting	51	141	11	496	2.44**
Fertilizer application	35	139	29	466	2.29**
Timely weeding	44	132	27	447	2.20**
Use of improved varieties	99	95	9	446	2.19**
Pest and disease control	71	102	30	423	2.08**
Transplanting	30	131	42	422	2.08**
Appropriate Planting date	24	125	54	412	2.03**
Appropriate Seed rate	50	119	34	394	1.94*
Appropriate Plant spacing	80	103	20	376	1.85*

**Adopted, *Not adopted

4.4 Effects of RRPPs' Adoption by Women Rice Farmers

The output of majority (90.2%) of the women rice farmers remained the same in the last three years (Table 4.21). This could be due to the fact that farmers had not adopted the correct spacing and seed rate. Only 5.9% of the women rice farmers reported increase in output. In the same manner, the income of majority (85.3%) had remain the same in the last three years. The average output of rice by farmers was about 3293kg , compared with the findings of Singh *et al.* (1997) of an average yield of 1.8tons paddy/ha and 4.6 tons per year. The lower outputs of rice from women's farms could be explained by the relatively less quantities of input use by the female farmers. Akpokodje *et al.* (2001) proposed the need for increased productivity in order to enhance competitiveness of rice in Nigeria.

Table 4.21: Distribution of women rice farmers based on effects of RRPPs' adoption (n=203)

Variables	Frequency	Percent
Change in output		
Decreased	7	3.4
Increased	12	5.9
Same	184	90.2
Change in income		
Decreased	13	6.4
Increased	16	7.8
Same	174	85.3

4.5 Factors Influencing Adoption RRPPs

The analysis of factors influencing adoption of RRPPs is presented in Tables 4.22; 4.23 and 4.24.

4.5.1 Socio-economic factors influencing adoption of RRPPs

The adjusted R^2 was 0.370 indicating that 37% of the contribution to RRPPs' adoption was explained by the variables included in the model.

Results of multiple regression analysis as shown in Table 4.22 revealed that only farm size was found to significantly influence adoption of RRPPs (2.860, $P < 0.01$) by women rice farmers in the study area. This variable was a strong determinant of adoption of RRPPs among women rice farmers.

Table 4.22: Socio-economic characteristics influencing adoption of RRPPs by women rice farmers

Variables	Coefficient	Standard error	t-value
Age	0.0150	0.0763	0.200

Marital status	0.2268	0.7952	0.290
Years of formal education	0.1478	0.1324	1.120
Household size	0.0383	0.1031	0.370
Farming experience	-0.0438	0.0657	-0.670
Farm size	2.6353	0.9219	2.860***

F-value = 6.21***

$R^2 = 0.396$

Adjusted $R^2 = 0.370$

*** $P < 0.01$

A strongly positive and significant relationship was found between women rice farmers' farm size and adoption of RRPPs (2.635, $P < 0.01$). Farmers with bigger farm size were better adopters, a result consistent with the findings of Ayoola *et al.* (2011). The probability of adoption given large farm size is 97%, making this factor the greatest driver of RRPPs' adoption by women rice farmers. Agbamu (2006) asserted that, there exists a significant relationship between the adoption of new farm practices and size of land of farmers. Therefore, lack of adequate farm lands by the majority of the women rice farmers in the study area caused hindrance to adoption of improved technology due to the fact that they have only but little land to strive for their utilization and commercial purposes and might not be ready to take risks of trying any new production technology. Considering land as one of the main required factor in production, Abu *et al.* (2011) reported that small farm size could be a factor which prevents farmers from adopting innovation because of the inappropriateness of modern technologies to the economic realities of small scale farmers. Farm size amongst other socio-economic factors was also found to be related to adoption and intensity of use of agricultural technologies.

Age, education, and household size were positive but not significant with the adoption of RRPPs. Also, though not significant, farming experience were negatively related with adoption of RRPPs.

Farming experience had a negative value (-0.670) but not significant to adoption of RRPPs. Household size had positive estimated coefficient toward the probability of adoption, but it was not significant at 5% level of probability. Ntege-Nanyeenya *et al.*, 1997 found similar result.

Education creates a favourable mental attitude for the acceptance of new practices. Education affords a person the ability to read and understand sophisticated information that may be contained in a package thereby increasing adoption. Farmers' exposure to

education increases their ability to obtain, process and utilize information relevant to the adoption of IPM technologies (Bonabana-Wabbi, 2002).

4.5.2 Technological attributes influencing adoption of RRPPs

The adjusted R^2 was 0.521 indicating that 52% of the contribution to RRPPs' adoption was explained by the variables included in the model while 48% was due to error. Hence, the model fit the study. Results of multiple regression analysis as shown in Table 4.23 revealed that relative advantage ($t=2.520$, $P<0.01$), and compatibility ($t=5.650$, $P<0.01$) were found to significantly influence adoption of RRPPs by women rice farmers in the study area. These variables were strong determinants of adoption of RRPPs among women rice farmers.

A strong but negative significance was found between complexity of RRPPs and adoption (-2.620). This indicates that the more complex the recommended practice is; the less the adoption. This result corroborates the report by NSADP (2010).

Table 4.23: Technological attributes influencing adoption of RRPPs by women rice farmers

Variables	Coefficient	Standard error	t-value
Relative advantage	0.2337	0.0817	2.520***
Compatibility	0.3519	0.0622	5.650***
Affordability	0.0161	0.1193	0.140
Complexity	-0.1251	0.0478	-2.620**

F-value = 12.68***

$R^2 = 0.544$

Adjusted $R^2 = 0.521$

*** $P<0.01$

4.5.3 Institutional factors influencing adoption of RRPPs

Results of multiple regression analysis as shown in Table 4.24 revealed that membership of association (-2.770, $P < 0.01$) though negative, significantly influence adoption of RRPPs by women rice farmers in the study area. These variable was a strong determinants of adoption of RRPPs among women rice farmers.

Contrary to *a priori* expectation, extension contact was found to be non-significant with adoption of RRPPs. Extension contact with farmers enhance acquisition of new knowledge, skill and practices on improved technology by the farmers as well as their innovativeness (Dey *et al.*, 2000; Tanko and Olowogbaji 2009) which is expected to translate into increased outputs. Contacts with extension agents afford the farmers the opportunity of sharing ideas and information on modern rice production practices by interacting with other farmers. This finding is consistent with earlier results by Enwerem and Ohajianya (2012) who found a positive but non-significant relationship between adoption and extension contact. This suggests that the extension services are not adequate in the survey area given the recommended extension agent to farmer ratio.

The adjusted R^2 was 0.451 indicating that 45% of the contribution to RRPPs' adoption was explained by the variables included in the model.

Table 4.24: Institutional factors influencing adoption of RRPPs by women rice farmers

Variables	Coefficient	Standard error	t-value
Extension contact	0.0826	0.1027	0.232
Amount of credit assessed	0.1618	0.0594	2.720***
Membership of association	-0.3248	0.1173	-2.770***
Access to information	0.0704	0.0883	0.800

F-value = 8.43***

$R^2 = 0.472$

Adjusted $R^2 = 0.451$

*** $P < 0.01$

** $P < 0.05$

4.6 Women Rice Farmers' Constraints to Adoption of RRPPs

Table 4.25 presents the result of constraints to adoption of RRPPs by women rice farmers. Unavailability of credit facilities, poor marketing system and unstable price; as

well as inadequate extension contacts were indicated by 92.1%; 64%; and 61.6% of the women rice farmers, respectively. Others major constraints include high cost of inputs (60%), and adulteration of inputs (58.6%). This result implies that women farmers were faced with myriads of constraints which limits their adoption of RRPPs. The implication of unavailability of credit facilities could be that the women rice farmers could not have the purchasing power for necessary farm inputs, which could reduce the level of adoption of rice production technologies among women rice farmers. Mustapha *et al.* (2012) found similar result. Agricultural production involves huge investments requiring availability of loan facilities to enhance and encourage adoption of technologies. Such loan facilities are mostly inaccessible by small farmers due to stringent conditions attached to its procurement. These conditions (e.g. high collateral, high interest rates, short moratorium) discourage small farmers (especially women who most of the times do not own major assets) from accessing the loan facilities. Poor pricing of agricultural produce especially at the time of glut makes rice farming unprofitable thereby discouraging expansion of farm and consequently limiting adoption of proven technologies. Extension contacts is supposed to enhance adoption. This is expected to be achieved by effective dissemination of technologies using various methods including regular training on the use of available technologies generated from research stations. The dwindling number of extension personnel in the State ADPs have been reported by NAERLS and FDAE (2014) as alarming.

Table 4.25: Women rice farmers' constraints to adoption of RRPPs (n=203)

Constraints to Adoption of RRPPs	Frequency	Percent	Rank
Unavailability of loan facilities	187	92.1	1st
Poor marketing system and unstable market prices	130	64.0	2nd
Poor and low extension contact	125	61.6	3rd
High cost of inputs	123	60.0	4th
Adulteration of herbicides	119	58.6	5th
Natural hazard, floods and drought	111	54.7	6th
High cost of tractor hiring and unavailable machineries	97	47.8	7th
Land tenure problem	79	38.9	8th
Transportation constraints	68	33.5	9th

Prevalence of pests and diseases	65	32.0	10 th
High cost of labour	45	22.2	11 th
Planting space of 25 x 25 cm is difficult	42	20.7	12 th
Low level of willingness to cultivate rice by young women	29	14.3	13 th
Poor storage system	28	13.8	14 th
Lack of fertilizer on time	21	10.3	15 th
Language barrier	1	.7	16 th

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study assessed the factors influencing adoption of recommended rice production practices by women farmers in western zone of Nasarawa State. A total of 203 women rice farmers were selected for the study using multi-stage sampling technique. Data were collected using structured interview schedule. Descriptive statistics (mean and percentages) and inferential statistics (Multiple regression and t-test) were used for data analysis. The results revealed that majority of the women rice farmers were less than 45 years old (70.9%), married (82.5%), had below secondary education (80%), had household-size of between 6 and 9 (40.2%), had farming experience of 10 years and above (80%), and inherited their farmlands (81.4%). Majority (75.5%) of the women rice farmers cultivate 1 hectare of land and below.

Only 23% of the women rice farmers had between ₦151, 000 and 200,000 annual farm income. Personal savings was the major source of fund ($M=2.56$) for farming activities. Majority (78.4%) of the women rice farmers received not more than ₦60,000 credit in the last one year. ADP was the most important sources of information for the women rice farmers ($M=2.12$). Women rice farmers' perception of compatibility, and affordability of RRPPs was high (2.219, and 2.17, respectively). Transplanting (2.17) and the use of appropriate plant spacing (2.16) were perceived as the most complex production practices while planting date (1.74) and use of improved variety (1.75) were the least complex practices. Women rice farmers were aware of all the RRPPs except recommended plant spacing. Harvesting (2.44), fertilizer application (2.29), and weeding (2.20) were the most adopted RRPPs.

The output of majority (90.2%) of the women rice farmers remained the same in the last three years (4.21). Income of majority (85.3%) had remain the same in the last three years. Unavailability of credit facilities, poor marketing system and unstable price; as well as inadequate extension contacts were indicated by 92.1%; 64%; and 61.6% of the women rice farmers respectively as constraints to adoption of RRPPs.

Results of multiple regression analysis of factors influencing adoption of RRPPs revealed that farm size (2.6353, $P<0.01$), amount of credit assessed (0.1618, $P<0.01$), membership of association (-0.3248, $P<0.01$), relative advantage (0.2337, $P<0.01$), compatibility (0.3519, $P<0.01$) and complexity (-0.1251, $P<0.05$) significantly influenced adoption of RRPPs by women rice farmers in the study area.

5.2 Conclusion

This study concludes that women rice farmers were aware of eight RRPPs introduced to them and that some of the recommended practices had high level of adoption. These were harvesting, fertilizer application, and weeding. However, some of the recommended practices were not adopted. These were seed rate and plant spacing. The low levels of adoption of these practices despite high level of awareness implied that there were other factors hindering adoption of those practices. Constraints hindering adoption of RRPPs were unavailability of credit facilities, poor marketing system and unstable price, and inadequate extension contacts. Adoption of RRPPs was significantly influenced by farm size, amount of credit assessed, membership of association, relative advantage, compatibility and complexity.

5.3 Recommendations

Based on the findings of this study, the following recommendations were made in order to improve the adoption of RRPPs by rice farmers in Nigeria:

- i. Relevant agencies should make credit facilities accessible to farmers.
- ii. Government should introduce an efficient marketing system by buying-back farmers' produce.
- iii. Women rice farmers should form viable cooperatives to enhance pulling of resources to combat the constraints to rice production.

5.4 Contributions to Knowledge

- i. This study found that farmers' adoption of RRPPs was significantly influenced by farm size (2.6353, $P < 0.01$), amount of credit assessed (0.1618, $P < 0.01$), relative advantage (0.2337, $P < 0.01$), and compatibility (0.3519, $P < 0.01$) significantly influence adoption of RRPPs by women rice farmers in the study area.
- ii. Also, adoption of RRPPs was negatively and significantly influenced by membership of association (-0.3248, $P < 0.01$) and the degree of complexity of RRPPs (-0.125, $P < 0.05$)

- iii. Unavailability of credit facilities, poor marketing system due to unstable price, and inadequate extension contacts were indicated by 92.1%; 64%; and 61.6% of the women rice farmers respectively, as constraints to adoption of RRPPs.

5.5 Suggestions for Further Studies

The importance following recommended rice production practices cannot be over-emphasized. Adoption of RRPPs will results in efficient use of inputs by farmers without which any appreciable measure of success in crop production can be guaranteed. This study assessed the extent to which RRPPs had been adopted by farmers. But, based on the experiences gathered in this study, there are other related areas which could be examined in future. These are as follows:

- i. Replication of this study in other zones of Nasarawa State.
- ii. Adoption of recommended rice production practices based on different varieties.

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Appendix: Interview schedule for farmers

FACTORS INFLUENCING ADOPTION OF RECOMMENDED RICE PRODUCTION PRACTICES BY WOMEN FARMERS IN WESTERN ZONE OF NASARAWA STATE

Interview schedule for farmers

Background Information

Name of interviewer:.....Phone:.....
Date.....

Time interview started:.....

Name of village:.....

Respondent's phone number:.....

Respondent's name (Optional):

Good day ma,

We are researchers from the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria. We are interested in talking to you about your farming practices specifically concerning your rice production practices. The aim is to assess how recommended rice production practices have been adopted. Hence, you have been selected because of your involvement in rice production. We shall be very grateful if you can give us part of your valuable time. Please feel free and answer the questions accurately and honestly. The result generated will be used purely for academic research purpose and your responses will be treated with utmost confidentiality.

Thank you.

SECTION A:

Socio-economic Characteristics, Institutional variables, and technological attributes:

a. Socio-economic characteristics

1. Age of farmer: years
2. Marital status:

i. Single ()	iii. Widowed ()	v.Others (specify)
ii. Married ()	iv. Divorced ()	

3. Years of formal Education: years

4. What is the average size of your farm?: ha.
 5. Size of Household: Total
 6. Years of farming experience: years
 7. Land

i. Inheritance ()	iii. Gift ()	v. Others (specify)
ii. Leasehold ()	iv. Purchase ()	

tenural status:

8. a. Do you use hired labour? i. Yes () ii. No ()
 b. If 'yes'; complete the table below appropriately

Farm operations	Nº of labour used	Amount paid per labour (₦)	Nº of times this operation is repeated per production cycle
i. Planting			
ii. Weeding			
iii. Fertilizer application			
iv. Spraying			
v. Harvesting			

b. Institutional Variables

9. Extension visit: How many times have you been visited by extension agents within the last 1 year? times.
 10. Cosmopolitaness:

Use of Radio:

- a. Do you have a radio in good working condition in your home? Yes () No ()
 b. If 'No', do you have a place you can listen to one? Yes () No ()
 c. Have you heard any agricultural programme on rice production practices on the radio? Yes () No ()
 d. If 'yes' what station was the programme aired? Pls specify
 e. How many times did you hear such programme? times.

Use of Television:

- a. Do you have a television in good working condition in your home? Yes () No ()
 b. If 'No', do you have a place you can watch one? Yes () No ()
 c. Have you heard any agricultural programme on the rice production practices on the television? Yes () No ()

- d. If 'yes' what station was the programme aired? Pls specify
- e. How many times did you hear such programme? times.

Frequency of travel:

- a. Have you ever traveled out of this village in the last one year? Yes... No...
- b. How many times have you traveled (for agricultural purpose only) in the last one year?

S/N	Places Visited	Frequency (in the last 1 year)
1	Other farms in the community	
2	Other villages in the LGA	
3	Other LGAs in the State	
4	Other States in the Country	

11. Access to credit

- a. Source of credit/capital for your farm: Rate the following sources

Sources	Rating		
	Very major (2)	Major (1)	Not major (0)
i. Bank credit ()			
ii. NGO ()			
iii. Input traders ()			
iv. Government institution ()			
v. Relatives/friends ()			
vi. Cooperative society ()			
vii. Personal savings ()			
viii. Others (specify)			

- b. What is the total amount of credit received in the last 1 year? ₦.....

12. a. Do you belong to an association? Yes () No ()

- b. Pls indicate the type of association you belong. (Tick as many as appropriate)

S/N	Organization	
1	Cooperative society	
2	Religious group	
3	Community-based group	
4	Social club	

5	Others (specify)	
---	------------------	--

13. Access to Information:

Please rate the following sources of information with respect to your use of recommended rice production practices.

S/N	Source	Rating		
		Very important (2)	Important (1)	Not important (0)
1	ADPs			
2	Research institutes			
3	Other farmers			
4	Village head			
5	Cooperatives			
6	Radio			
7	Television			
8	Newspaper			
9	Internet			
10	Agricultural show			
11	Others (specify).....			

c. Technological attributes

Perception of relevancy (relative advantage, compatibility, affordability, and complexity) of RRPPs:

14. What is your perception of relevancy of the recommended practices to your farming situation? Please tick appropriately

a. Relative Advantage

RRPPs	Perception of Relative Advantage		
	Very Compatible	Compatible	Not compatible

i. Improved varieties			
ii. Planting date			
iii. Seed rate			
iv. Fertilizer application			
v. Weeding			
vi. Plant spacing			
vii. Transplanting			
viii. Pests and disease control			
ix. Harvesting			

b. Compatibility

RRPPs	Perception of Compatibility		
	Highly Advantageous	Advantageous	Not Advantageous
i. Improved varieties			
ii. Planting date			
iii. Seed rate			
iv. Fertilizer application			
v. Weeding			
vi. Plant spacing			
vii. Transplanting			
viii. Pests and disease control			
ix. Harvesting			

c. Affordability

RRPPs	Perception of Affordability		
	Very Affordable	Affordable	Not affordable
i. Improved varieties			
ii. Planting date			
iii. Seed rate			
iv. Fertilizer application			
v. Weeding			
vi. Plant spacing			
vii. Transplanting			
viii. Pests and disease control			
ix. Harvesting			

d. Complexity

RRPPs	Perception of Complexity		
	Very complex	Complex	Not complex
i. Improved varieties			
ii. Planting date			
iii. Seed rate			
iv. Fertilizer application			
v. Weeding			
vi. Plant spacing			
vii. Transplanting			
viii. Pests and disease control			
ix. Harvesting			

15. Output of rice (from the last harvest):

Size of land cultivated	Total Output (kg or bag)	Quantity Consumed (kg or bag)	Quantity given out as gift (kg)	Quantity sold (kg or bag)	Price/unit (₦)

to rice (ha)			or bag)		

16. What is your total income from rice production last year? ₦.....

SECTION B:

Level of Awareness and Adoption of RRPPs

17. Rate your level of awareness and adoption of the following practices: (Circle the appropriate one)

S/ N	Recommended Rice Production Practices	VARIABLES					
		LEVEL OF AWARENESS			LEVEL OF ADOPTION		
		Unaware at all	Have little awareness & understanding	Fully aware & understand it	Very Often	Seldom	Never
1	Improved varieties	0	1	2	2	1	0
2	Planting date	0	1	2	2	1	0
3	Seed rate	0	1	2	2	1	0
4	Fertilizer application	0	1	2	2	1	0
5	Weeding	0	1	2	2	1	0
6	Plant spacing	0	1	2	2	1	0
7	Transplanting	0	1	2	2	1	0
8	Pests and disease control	0	1	2	2	1	0
9	Harvesting	0	1	2	2	1	0

SECTION C: Effects of adopting RRPPs on yield and income

18. Effects of adopting RRPPs on yield and income

Variable	Effect of RRPPs' adoption			
	Increased	Decreased	Same	Dont know
Yield				
Income				

SECTION D: Constraints to adoption of RRPPs:

19. To what extent has the following constrained your adoption of RRPPs?

S/N	Constraints to adoption of RRPPs	Rating
1	High cost of improved seeds	
2	Adulteration of chemicals	
3	Land tenure problem	
4	Inadequate production facilities	
5	Scarcity of improved seeds	
6	Inadequate technical knowhow	
7	Inadequate access to inputs	
8	High cost of inputs	
9	Prevalence of pests	
10	Inadequate capital	
11	Others (specify).....	

Rating scale

Very often 4

Often 3

Seldom 2

Occasionally 1

Never 0

20. Length of use: How long have you been using each of the RRPPs on your farm?

.....years

21. What (in your own opinion) is/are the ways by which the adoption of RRPPs can be encouraged among women farmers?

Please list them:

.....

The End

Thank you very much for your cooperation

Interviewer's comment:

Time Interview ended: