ADOPTION OF RICE PRODUCTION TECHNOLOGIES INTRODUCED BY AGRICULTURAL RESEARCH OUTREACH CENTRES AMONG RICE FARMERS IN CENTRAL AGRICULTURAL ZONE OF NIGER STATE, NIGERIA

BY

YUSUF NUHU
NSU/AEX/M.Sc./0006/16/17

A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, NASARAWA STATE UNIVERSITY, KEFFI, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS OF SCIENCE (M.Sc) DEGREE IN AGRICULTURAL EXTENSION AND COMMUNICATION

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION
FACULTY OF AGRICULTURE, NASARAWA STATE UNIVERSITY, KEFFI, NIGERIA.

DECLARATION

I hereby declare that this dissertation titled: '**Adoption of Rice Production Technologies Introduced by Agricultural Research Outreach Centres (AROCs) Among Rice Farmers in Central Agricultural zone of Niger State, Nigeria'** has been written by me and it is a report of my own research work. It has not been presented in any previous application for the award of Master of Science degree. All quotations are indicated and sources of information specifically acknowledged by means of references.

…… ……

Nuhu Yusuf Date

NSU/AEX/M.Sc./0006/16/17

CERTIFICATION

This dissertation titled: **Adoption of Rice Production Technologies Introduced by Agricultural Research Outreach Centres (AROCs) among Rice Farmers in Central Agricultural zone of Niger State, Nigeria** by Nuhu Yusuf, meets the regulations governing the award of Master of Science degree of the School of Postgraduate Studies, Nasarawa State University, Keffi, and is approved for its contribution to knowledge.

……. …….
Dr. E. S. Salau Date
Chairman, Supervisory Committee

....
Dr. O.E. Galadima Date
Member, Supervisory Commitee

....
Dr. S. I. Audu Date
Head of Department

....
Prof. A. B. Ogunwale Date
Internal Examiner

....
Prof. O. J. Jayeoba Date
Dean of Faculty of Agriculture

....
Prof. C.P.O Obinne Date
External Examiner

....
Prof. J.M. Ayuba
Dean, School of Postgraduate Studies Date

DEDICATION

This work is dedicated to Almighty ALLAH, the Creator of heaven and the earth in whom I owe my existence.

ACKNOWLEDGEMENTS

I thank the Creator of the universe, the Almighty Allah for giving me the opportunity to carry out this programme.

I wish to express my sincere appreciation to my supportive supervisors in persons of Dr. E. S. Salau and Dr. O.E. Galadima for their guidance and constructive criticisms that make this work a reality. I am highly grateful to the Head of Department, Dr. S. I. Audu and academic staff of the Department of Agricultural Economics and Extension, particularly Prof. A. B. Ogunwale, Dr. H. S. Umar, Dr. A. A. Gerei and Dr. E.G. Luka, for their support towards the success and completion of this study.

Finally, I wish to express deep appreciation to my loving and caring wife, Mrs Jamila Jibrin Umar and my children, Nurudeen, Hafsah, Jibrin and Mustapha for their cooperation and understanding at all times during this study. May Allah Almighty bless you all.

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ABSTRACT

The study assessed adoption of rice production technologies introduced by Agricultural Research Outreach Centres (AROCs) among respondents in Agricultural Central zone 'A' of Niger State. The data utilized were derived from primary sources using structured interview schedule administered to 180 randomly selected rice farmers from the study area. Data were analysed using both descriptive and inferential statistics such as frequency, percentage, mean and multiple regression. The result shows that 74.4% (majority) of rice farmers were at their middle and agriculturally productive age (50 years) and majority (97%) were male. Majority (71%) of the respondents acquired their farm land through inheritance with 98.8% of them having an average of 3.5 hectares of rice farm lands. The mean annual income for respondents was ₦250, 000. The sources of information on rice production most frequently used by the respondents were Extension services (98.8%) and Fellow farmers (45.5%). This shows that personal information source was also efficient in propagating complex information such as innovation packages of rice production. The rice production technologies with very high adoption rate included Improved harvesting techniques (98.8%), NERICA 1-upland (95%), Transplanting after sowing in nursery (93%), Optimum sowing period of May – July (93%), Improved weed control-(93%), Improved pests control using seed treatment (92%), Recommended fertilizer rate (91%), Proper use and type of herbicides (90%), Transplanting 2-3/hill and FARO 44-sipi lowland (81%). The study revealed that the variables that were significant determinants of accepting innovations on rice production in the regression analysis include Age (t= -3.88), Farming Experience (t= -3.121), Educational level/years spent in school (t = 8.20) and AROC Staff visits (t = 5.074), were all significant at 1% level while Farm size (t = 0.0511) was significant at 10% probability level. The R^2 indicated that 85% variation in the output of AROC's introduced rice production technologies was described by variables incorporated in the model and this shows the best fit of the Model. The variables identified as serious constraints with mean score x >2 were inadequate capital, poor access to modern information sources, high cost of improved farm inputs, weak social network and inadequate farm land. In line with the results of this study, it was concluded that despite the challenges faced by the rice farmers, there was very high rate of acceptance of innovation packages on AROC's introduced rice production. The study therefore recommended that government and relevant stakeholders should prioritize establishment of the best extension teaching methods and systems as well as administration to help increase rate of adoption of innovations and sustainability of the use of these technologies over time.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the study

The existence of wide-spread poverty in Nigeria despite the amazing resource potentials (natural and human) is inconsistent with the principles of Sustainable Development Goals, especially the first sustainable development goal of no hunger before the year 2030 (FMARD, 2016). According to the World Bank (2017), Nigeria has a population of about 186 million people, the largest in Africa almost accounting for 47 percent of West Africa's population, and has one of the largest population of youths in the world. As the population increases, the country's demand for food increases, while the ability to produce food diminishes because of pressures from the growing population and other external pressures in the forms of desertification, climate change and erosion impacting negatively on the already diminishing resources and further threatening food production.

According to Ahmed (2013), majority of Nigerian farmers consumes most of their produce and persistently produce on fragmented farmlands as a result of inheritance and .population detonation" Development Indicators in the rural areas which are home to majority of the nation's farmers, lag far behind those in the urban areas with low income levels, high literacy, high infant mortality, shorter life expectancy and malnutrition.

Consequent upon this development, Ruma (2007) posit that Nigerian farmers produced almost 90 percent of their agricultural harvest with less than 2 hectares under cultivation. Typical farm sizes ranges from 0.5 hectares in the densely populated high rainfall south to 4 hectares in the dry north. The system is generally characterised by rainfed production at low levels of inputs thereby resulting in low-output labour productivity. The major impact of this on the generality of farmers

in Nigeria is that it will lead to high cost of production, low/none investment profit resulting to high standard of living and increase poverty level, unemployment and food insecurity.

In the past, one of the leading Nation in terms of food production self-sufficiency was Nigeria. however, the situation has since changed and the food security situation is likely to deteriorate if urgent steps are not taken to put the country on the path of sustained agricultural growth. It suffices to note that Nigeria has about 79 million ha of arable land, 214 billion m3 of surface water and 87 km3 groundwater both of which can partly be used for both rain fed crop and irrigation (FAO, 2013). Therefore, for the past 7 years government has accorded rice production the priority it deserved in line with its status as one of the importance staple food in Nigeria. Significant progress has been recorded in Nigeria with a rice production that reached a peak of 3.7 million tonnes in 2017 (PwC, 2018).

But the rapid increase in population of Nigeria has consequences in huge raise in the demand for rice which is consumed virtually by both rural and urban households in Nigeria. (Oladimeji, 2017). For instance, the growth in rice productivity remains limited due to insufficient supply chain integration, the 2016 estimate of Nigerian rice demand was 6.3 million tons and the supply was 2.3 million tons creating a huge gap of 4.0 million tons, hence rice imports still exceeds $1 billion annually (FMARD, 2016). The major impacts of rice importation to the Nigerian Agricultural development are injurious to Nigeria's economy with negative effect on the Gross Domestic Product (GDP) thereby weakening the Nation's foreign reserves. It also exposes country to high inflation and unemployment. This however, destructs the Nigerian Agricultural Development and intricate the Sustainable Development Goal of the United Nation of achieving Zero hunger by 2030.

Additionally, Nigeria at present has the largest and most elaborate NARES in the entire Sub-Saharan Africa. The Nigerian NARES is comprised of: eighteen (18) NARIs, three (3) Agricultural Universities, 19 FCAs, 47 Faculties of Agriculture in regular Federal Universities, eight (8) Faculties of Veterinary Medicine, four (4) International Agricultural Research Centres (IITA, ILRI, ICRISAT, Africa Rice); and several Organized Private Sectors (OPSs), Non-Governmental Organization (NGOs), Community Based Organizations (CBOs), Framers Based Organizations (FBOs) (ARCN, 2012) and yet Nigeria is still categorized among the food-deficit or food insecure nation in Africa.

Arokoyo (2009) observed that the Nigeria's awesome National Agricultural Research and Extension System (NARES) has not been able to engineer a sustainable agricultural development that would ensure national and household food security, improved rural livelihoods and indeed, make Nigeria's agriculture competitive in the world agricultural market today. This however might resulted to major problem in the Agricultural Sector of its low contribution to the National Economy or Gross Domestic Product (GDP) and negative consequences to National Development such as unemployment, urban influx, social unrest and general insecurity.

The Agricultural Research Outreach Centre (AROC) is an established centre sited within each of the identified adopted village communities in an accessible location to the farmers. According to (ARCN, 2009) the main objectives of the AROC centres are to serve as a knowledge/resource centre for the contiguous farming communities, where all available relevant information on agriculture and other aspects of community livelihood would be displayed; serve the purpose of farm service centre where NARIs and FCAs will display available technologies and render services to the communities; serve as training venue where NARIs and FCAs will conduct

training for the farmers; serve as a demonstration centre; and serve as outreach centre where feedback on technologies being promoted could be received.

The scheme was aimed to smooth the progress of testing of findings of new research under farmer's environmental situations. It also has additional advantages of participatory approach resulting to interaction between the farmers and researchers or executors. The taking part of farmers will ease the diffusion and increase the rate of adoption of such technologies by neighbouring farming communities, as the field trial will be used as demonstration plot. Also, technologies generated in the Institute are taken to the adopted villages for dissemination to farm families in the adopted villages (Adeogun *et al.,* 2017).

The AROC centres focused by this study are those established by the National Cereal Research Institute (NCRI), Badeggi in Bida Local Government of Niger State. NCRI was established by decree 13 of 1975, with the mandate to conduct research into the genetic improvement and production of the major stable grains like rice, maize, cowpea and sugarcane. The re-organization of the agricultural research system in 1987 gave NCRI new mandate crops which were Rice, Soybean, Beniseed, Sugarcane, and the farming system in the Middle belt comprising of Benue, Kogi, Kwara, Nassarawa, Niger, Plateau, Taraba States and the Federal Capital Territory, Abuja.

In the area of rice research and extension, NCRI has so far released 57 improved rice varieties which most farmers are using in Nigeria. This has enabled the farmers increase their yields and income. Improved rice processing technology has been developed by the institute. Rice yield could increase due to growers using improved rice varieties capable of fostering rural development through boosting food security, improve nutrition and supporting soil conservation sustainably (Jirgi *et al*., 2009). According to Mustapha *et al* (2012) improvement in rice

production requires farmers to adopt improved farming techniques. If farmers adopt and apply the improved techniques well, there would be increased productivity. But, if vice versa the consequences are high production cost and low yield.

1.2 Statement of the Problem

The United Nations Development Programme's (UNDP) annual ranking of countries based on development indicators, ranked Nigeria as 84th out of a total of 119 counties on the 2017 Global Hunger Index (Klaus *et al.,* 2017); and the Global Food Security Index (GFSI) assessed 113 countries in 2016 and Nigeria was 90th with 39.4 score based on indices of affordability, availability, quality and safety. (Thomas *et al.,* 2017). According to the National Bureau of Statistic's 2016 report, 67.1 percent of the total population (112 million) of Nigeria are living below the poverty line. (/2016/10/poverty-112m-nigerians-live / https://www.vanguardngr.com accessed on 2nd December, 2018). This despite the fact that studies revealed that Nigeria within Sub-Saharan Africa has the largest and most elaborate National Agricultural Research and Extension System (NARES). Therefore the concern over the existence of wide – spread poverty in Nigeria despite the high food production potentials such as the huge number of improved Agricultural technologies emanating from the NARES has been worrisome.

If the available technologies developed by the NARES/NARIs were adopted and accepted by the farmers, It is believed that Nigerian agriculture can witness a notable improvements. According to Ogunwale *et al.,* 2006 and Iheanacho, 2006; the accomplishment of any innovation depends on its diffusion among potential users and is determined by its adoption level.

However, over the years government had been implementing various intervention projects to fast-tract appropriate approach for argumenting extension services to the farmers but lack of research on the early assessment and inadequate relevant data to make policy decisions on

priority settings and efficacy of such interventions resulted to low Agricultural Productivity. This led to high production cost, low productivity and negative economic consequences such as poor standard of living, hunger, malnutrition, disease and unemployment. Recently Agricultural Research Outreach Centres (AROCs) has been promoted as one of the interventionist strategy in the Central Agricultural Zone 'A' of Niger State, Nigeria to facilitate the dissemination of improved rice production technologies to farmers and increase rice production.

It was revealed that there is inadequate information/data to illuminate the influence of these centres (AROCs) on the rice farmers and to offer policy makers the decision tools on such extension service intervention. This was likely due to none conduct of any empirical study on the assessment of the adoption of improved technologies on rice production introduced by these AROC centres within Central Agricultural zone 'A' of Niger State. Hence, the study intended to provide answers to the following research questions:

i) What are the socio-economic characteristics of the rice farmers in the study area?
ii) What are the sources of information on rice production technologies most frequently used by the respondents in the area?
iii) What is the rate of adoption of Agricultural Research Outreach centre's (AROC's) introduced rice production technologies by the respondents in the study area?
iv) What are the effects of respondent's socio-economic characteristics on their adoption level of AROC's introduced rice production technologies?
v) What are the constraints to the adoption of AROC introduced rice production technologies by the respondents?

1.3 Objectives of the study

The broad goal of the study is to appraise the adoption of AROCs Centre's introduced rice production technologies by the Rice Farmers in the Central Agricultural Zone 'A' of Niger State.

The specific objectives are to:

i) describe the socio-economic characteristics of rice farmers in the study area;

ii) identify the sources of information on rice production technologies most frequently used by the respondents;

iii) determine the rate of adoption of rice production technologies introduced by Agricultural Research Outreach Centre (AROC) by the respondents;

iv) determine the effects of respondent's socio-economic characteristics on their adoption rate of AROC's introduced rice technologies.

v) determine the constraints to the adoption of AROC's introduced rice technologies by the respondents.

1.4 Research Hypotheses

The following hypotheses stated in null form were stated in the study

H_{01}: There is no significant relationship between the socio-economic characteristics of the rice farmers and their rate of adoption of AROC's introduced Rice Technologies in the area under study.

H_{02}: There is no significant relationship between the effects of respondent's socio-economic characteristics and their rate of Adoption of AROC's introduced Rice Production technologies in the area under study.

1.5 Significance of the study

The motivation for this research work derives from the need to increase rice production at the local level through adoption of improved agricultural technologies and modern agronomic practices. Hence, rice production technologies introduced by AROC centres were part of the intervention strategies employed to improve standard of living and food security in Central Agricultural Zone (A) of Niger State. This can be achieved, if a thorough study will help to design more workable and effective intervention to increase agricultural productivity for food security, since measures to increase agricultural production employed by government have had little impact on the poor resource farmer and other rural households.

Therefore, the results from this research work will provide direction to policy makers or administrators in designing relevant policies and priority setting to avoid wastage of already limited resources and maximize benefit of such interventions for achieving the Sustainable Development Goals target of zero hunger by year 2030. It will also provide vital information on determining the success or otherwise of the Adopted Village programme in order to elucidate the relevance of the AROC centre's activities to relevant donor agencies and other stakeholders. Additionally, the outcome of the research will serve as blueprint for researchers and students who wish to venture into similar research work and in the process provide valuable literature to guide their research. The result of this study will also pave ways towards integrating other

interventions that can accelerate technology adoption and emergence of profitable Rice Innovation Platforms that can boost famer's productivity.

1.6 Operational Definition of Terms

i. Adopted Village: It is a village/town consisting of contiguous farming communities identified and selected by agricultural research institute to serve as a showroom for the innovations generated from the institute and also for early assessment of its suitability.

ii. Adopted Village Programme: It is an intervention design to disseminate new agricultural innovations generated by the Agricultural Research System to the farmers through selecting key villages and establishing AROC centres and Demonstration plots in such villages.

iii. Agricultural Research Outreach Centre (AROC): This is a centre established by the agricultural research institute and located at the adopted village to serve as agricultural technologies resource centre for the farmers.

iv. National Cereal Research Institute (NCRI): It is one of the 15 Agricultural Research Institute in Nigeria, located at Badeggi – Bida, Niger state. Its saddle with the responsibility of conducting research into the genetic improvement and production of the major stable grains like rice, maize, cowpea and sugarcane.

v. Rice Production Technologies: These are new technologies and improved agronomic practices introduced by NCRI through the Adopted Village programme.

vi. ARCN: Agricultural Research Council of Nigeria is an agency under the purview of the Federal Ministry of Agriculture. Its saddled with the responsibilities of coordinating, supervising and monitoring the activities of 15- NARIs and 11- FCAs in Nigeria.

vii. Adoption: It is a gradual process (mental) that a person undergoes from hearing about a technology/innovation for the first time to the final decision of whether to accept or reject

viii. Diffusion: It is defined as spray of information within social system over time. It's a special communication with aim and target goals

ix. Level of Adoption: It is the amount of innovation that has being absorb/diffused. Its measured as percentage of the amount of innovations adopted by the total number of innovations introduced or disseminated.

x. Adoption Rate: It is usually measured by number adopters per unit time or measured as percentage of the number of farmers that adopted a technology per period of time by the total number of farmers.

xi. Innovation: It is defined as anything that is considered new by individual or group. Its classified as software (e.g planting space, planting date, piece of information etc) and hardware (e.g Seed varieties, tools etc).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Concepts relevant to the study

2.1.1 Adoption: It is commonly refers to the resolution to make use of new innovations or modern agricultural practices by economic units on a normal basis. Diffusion often refers to as spray of information or new technology among different economic units over time. Many researchers belonging to different disciplines have defined the two concepts in relation to their own fields. Among others, the definition given by Rogers (2003) is widely used in several adoption and diffusion studies. Rogers (2003) made a distinction between adoption and diffusion. He defined diffusion (aggregate adoption) as the methodology employ to spread information on new innovations among the members of a social system through certain communication channels over time. This definition recognize four elements namely: (a) the technology that represents the new idea, practice, or object being diffused, (b) communication channels which represent the way information about the new technology flows from change agents (extension, technology suppliers) to final users or adopters (e.g., farmers), (c) the time period over which a social system adopts a technology, and (d) the social system. Rogers (1995) then defined adoption as acceptance or rejection of new innovation by end-user per unit time. Adoption is a behavioural choice at a particular time and space while diffusion is the adoption pattern over time.

Feder et al. (1985) in Beever (2018) distinguished individual adoption (farm level) from aggregate adoption. Individual (farm level) adoption was defined as the degree of utilization of a new innovation after the farmer must have been aware or has full information about the new innovation and its potentials. Aggregate adoption (diffusion) was defined as the process of

disseminating technology within a region. This meaning implies that aggregate adoption can be measured by the aggregate level of utilization of an innovation within a given geographical area. The decision process of adoption entails selection of area, level of utilization or rate of application if the innovation can be separated (e.g herbicide, fertilizer or improved seed). However, decision process of adoption requires choices of quantity of resource (i.e. land) to be billed to the new and old innovations if the innovation is not separable (e.g. mechanization, irrigation). (Feder *et al*., 1985 in Beever, 2018). Thus, the process of adoption decision includes the simultaneous choice of whether to adopt a technology or not and the intensity of its use.

2.1.2. Rice: Rice belongs to family of Oryza sativa or Oryza glaberrima grass species. It is a cereal grain that is most widely consumed as staple food by large part of the world's population, particularly Asia and Africa. After sugarcane and maize, Rice stands as the third-highest worldwide most produced agricultural commodity. (https://en.wikipedia.org/wiki/Rice Accessed on 3rd December, 2018). Saka and Lawal (2009) categorized rice as the most vital commodity that served/ stand for about 80 percent of food need of over 50 percent of the World population. USAID (2010) asserted that Nigerian market recommends the following improved varieties based on the demonstrated evidence of high yield by research institutes and the outcome of project intervention in the previous years; lowland rain-fed and irrigated rice –FARO 44 (sippi 692033) and , FARO 52 (WITA – 4). Upland varieties are FARO- 46 (ITA150) and FARO 55 (Nerica-1). FARO means Federal Agriculture Research Oryza. It originated from Taiwan and has national code as NGOs-9144. According to National Centre for Genetic Resources and .Biotechnology (NCGRBC) (2009), FARO-44 was released and registered in the year 1990 and 1991.However,FARO-44 was developed by the following institutes: West Africa Rice Development Association (WARDA), International Institute of Tropical Agriculture (IITA) and

National Cereal Research Institute (NCRI). FARO 44, (Sippi 692033) is lay to rest explicit hybrid among the local African rice and Taiwan rice which brings new opportunities for farmers in Nigeria. FARO 44 variety has unique characteristics such as early maturity (110 – 120 days) earlier than traditional varieties, higher yield, tolerant to some stresses, resistant to blast, long grain etc (Dontsop, Diagne, Okoruwa and Ojehomon, 2011).

2.1.3 Technology: A technology is every initiative, item or practice that is alleged as innovative or new by the members of a social system (San, 2014). Technological innovations is the application of new scientific and technological knowhow that substantially improved services, production processes (process innovation) and generally bring about changes in goods (product innovation). The input to a production process is refers to as process innovation, while the end product for utilization is called product innovation (San, 2014). The agricultural technologies considered in this study fall in the first category (Process Innovation). In this study the terms innovation and technology are interchangeably used.

2.1.4 Adopted Village/AROC: The concept of Adopted Village and AROC intervention was introduced for developing and evaluating agricultural innovations generated by Agricultural Research System nation-wide. The villages were to assist in the primitive assessment and propagation of the new innovations and to be showroom for convincing relevant stakeholders that investment in research is worthwhile (NARSP, 1996). Adopted Village/AROC intervention is expected amongst others to increase productivity, economically empower farmers, create job and reduce food insecurity through encouraging farmers to adopt new innovations in large scale and involve in participatory technology development.

2.1.5 Conceptual Framework for the study:

For this study, the conceptual framework posits that the rice farmer's socio-economic characteristics will affect their output. It also posits that intervening variables such as Institutional, technical, production and environmental factors will influence quality of out put. From the framework, the interplay of the independent and dependent variables is expected to have effect on level of adopted of AROC's introduced Rice production technologies.

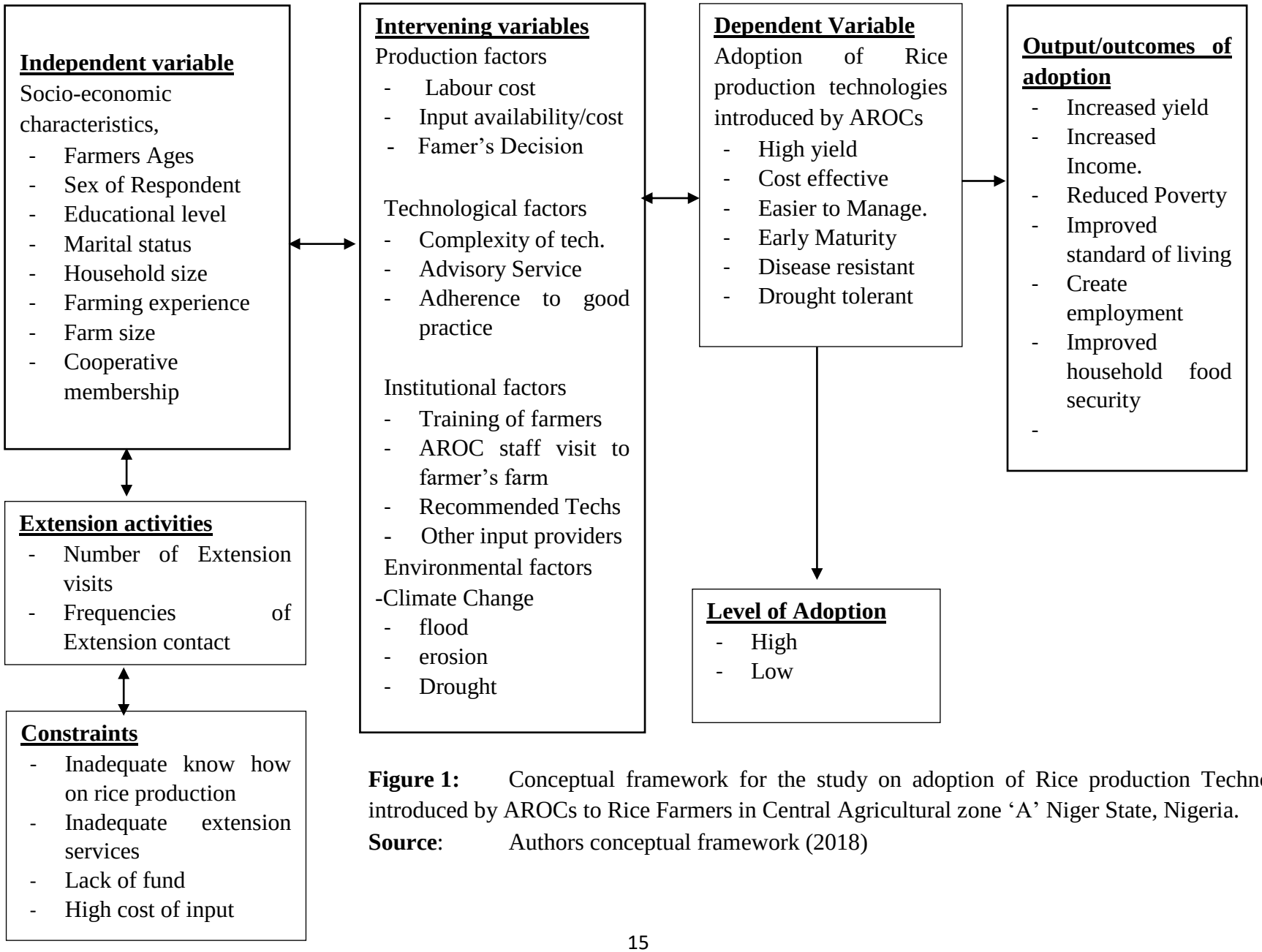

Figure 1: Conceptual framework for the study on adoption of Rice production Technologies introduced by AROCs to Rice Farmers in Central Agricultural zone 'A' Niger State, Nigeria.

Source: Authors conceptual framework (2018)

2.2 Theoretical Framework

The theoretical background of this study is based on the theory of diffusion as it seeks to explain the process and channels through which innovation reaches individuals within a social system.

2.2.1 Theories of Adoption

The decision of farmers to adopt innovation is a complex process with a wide number of influencing factors. A key question in trying to determine the future of adoption with the technology environment is determining why an individual would adopt one technology while resisting another (Kathryn, 2010). Therefore, in terms of this study, user acceptance is the willingness of farmers to use innovations. With respect to the above, interest is focused to identify the dynamics that control the taking up of new innovations by users who have some degree of choice. However, due to the wide-ranging issues of why some farmers would accept or reject a technology it is unlikely that a single variable explanation could account for this decision (Dillon, 2004). Based on this, a number of theories have been developed to help understand and explain adoption process of end users. Adoption is not one step process, which means it takes time for adoption to be complete. Agricultural extension can be said to be effective and efficient when farmers adopt improved technologies (Aphunu, 2011). Adoption is therefore similar to diffusion except that it deals with psychological process an individual goes through, rather than the physical process.

2.2.2 Diffusion Theory

This theory is the brainchild of Everest Rogers who stated that diffusion can be defined as the process use to converse idea among members of a social system by means of certain channels and over period of time (Rogers, 2003). This theory however, predicts that an innovation will initially be adopted by small group of innovative farmers and letter diffuse to other farmers

within the social system (Stephenson, 2013). The central objective of diffusion research is on the reams of adopting agricultural innovations such as herbicides, hybrid seeds, pesticides and, fertilizers and modern agricultural practices as to improve their standard of living. According to Surry (1997) in Aphunu, (2011), the most important fact to consider in discussing diffusion theory is that it is not well-defined uniform and comprehensive theory. A large number of theories from a wide variety of discipline each focusing on a different element of the innovation process, combine to create a meta-theory of diffusion .Four of the most widely used theories of diffusion of innovation discussed by Rogers are innovation decision process, individual innovativeness, rate of adoption and perceived attribute of innovation (Surry, 1997 in Aphunu, 2011).

Rogers (2003) presented four adoption/diffusion theories which include:

a) **Innovation Decision Process theory**: The diffusion process of any potential adopters of an innovation usually progresses through five stages over time viz: Knowledge - must have had information about the innovation; Persuasion - convinced on the benefits to be derived; decision- must take decision to accept it; Implementation - put into practice the innovation; and lastly, Affirmation - the decision taken must be reiterate ed or rejected.

b) **Innovativeness theory**: Early adoption of innovation in the field of adoption/diffusion is made by individuals who are innovative and usually known for their capacity to take risk.

c) **Adoption Rate theory**: Diffusion process occurs gradually at a given time frame with innovations departing from slow, steady growth, dramatic and rapid growth, and then to a steady stabilization and finally a turn down.

d) **Perceived Attributes theory**: The theory stated that every innovation can be influence by five different factors which include: Trialability, Observability, Relative Advantage, Complexity, and

Compatibility. This however, entails that the innovation can be tried, results be observed, its advantages over others be manifested, it should not be too complex to understand/utilize, and finally be compatible with the adoption circumstances.

In the context of either bottom-up or top-down adoption/diffusion process and in either macro-level or micro-level reforms, each of the above can be considered.

Other theories of Adoption are:

e) Transfer of Technology (ToT) Model: It is believe that transferring innovation and vital agricultural information to famers by researchers will initiate development. The function of agricultural extension agents within the ToT model is to assist farmers. In putting the blue prints or ready-made technologies into practice, despite the fact that they may not be appropriate to the prevailing environment of the farmers. Extension practitioners assumed that as progressive farmers adopt innovations, they are being observed by other less innovative farmers who get influenced and later would adopt the innovations, and the innovations will spread to majority of farmers. In practice, this assumption often proves invalid. According to Hagmann, *et al*. (1999), in many cases, the laggards are jealous of the mote advanced farmers who are then victimized, rather than copied. Knowledge may also be considered a strong basis of power. Information as well as innovations may therefore not necessarily be shared outside the 'elitist club' of close relatives and friends. The ToT approach had resulted in poor adoption rates of technologies due to the following factors:

a. Poor performance of researcher's technologies under farmers management;
b. Neglect of key stumbling blocks for successful development (socio-cultural, organizational and political issue at community level), and;
c. Neglect of the people's indigenous knowledge.

g). **Participatory Technology Development and Extension Model**: As a result of the failure of Transfer of Technology (ToT) approach, there have been calls to rethink this model in order to develop more effective approaches of stimulating farmers to adopt technologies for development of themselves and their communities. In the 1990s, participatory research amid extension approaches emerged. Participatory technology development and participatory extension approach ensured the development of technologies together with farmers, farmer experimentation and evaluation, sharing of experiences and farmers to farmer innovation dissemination with extension workers as facilitators. The main shift in orientation occurred when the enhancement of farmers' capacity to develop and diffuse technologies and techniques among themselves became accepted as the foundation of agricultural development. This substantially changed the roles of farmers and outsiders in the diffusion of innovations.

Given that a multitude of social and cultural factors affect how a farmer will choose to farm, Hagmann et al. (1999) argued that it is an illusion that outsiders can ever understand the totality of factors which make local stakeholders behave as they do. Therefore, technology or innovation and knowledge in general cannot be transferred wholesale from one area organization or culture to another. They posited that for successful technology development, farmer's reed to experiment with techniques and ideas, adapt, evaluate and determine the practices most appropriate for their own situation. The capacity of farmers to do this by themselves needs to be strengthened.

h) Authoritarian Imposition of Technologies: Yates (1995) posits that new innovations are conveyed mainly through authoritarian imposition and voluntary adoption. Adoption by voluntary means depends exclusively on the efficiency of demonstration which may be very rapid or slow. However, the problem with authoritarian approach was non-sustainability/stability or discontinuity with inadequate funding or when other incentives dry up. But in the case of

voluntary adoption, adoption might not likely to be discontinued but increased vigorously because the innovation is very much suitable/appropriate to the clientele.

i) Transfer of Technology through Emulation: This is portrayed as one of the most pervasive form of acceptance of new technologies. It involves one that has successfully adopted the technology. For technologies to be appropriate the developer of the technologies and the end user (farmer clientele) must be able to understand and appreciate the technologies and must be fully convinced and aware that the technologies will be economically viable (Yates, 1995). However, for a researcher to be able to develop an appropriate technology, he must be aware and fully comprehend the problems of the clientele (farmers). The researcher must therefore know and realize that the clientele is not an immutable, stereotyped individual with fixed beliefs and ideas.

This research work is based on Participatory Technology Development Model and participatory extension approach as explained on (g) above. It ensured the development of technologies and extension together with farmers, farmer experimentation and evaluation, sharing of experiences and farmers to farmer innovation dissemination with extension workers as facilitators.

2.3 Methodological Framework

Akinola *et al*. (2017) in their study conducted in Kaduna State on Adopted Village Project and Beneficiary's Farm Earnings, where the respondents were selected using multi-sampling technique (purposive random sampling techniques). While in the analysis of collected data, descriptive statistics and Z-test statistics were used.

Afolabi *et al.* (2012) in a study conducted in Ekiti and Ogun States on determining the impact of farmers' membership of cooperative societies on rice production. In the sampling procedure and data analysis, a Multistage sampling technique and descriptive statistics were used respectively.

Additionally, budgetary technique and inferential statistics were also employed in analysing the collected data. Against the backdrop that promotion of cooperative society membership amongst farmers results to increase in accessibility of farm input, thereby increases productivity and income of the farmers.

Babalola *et al.* (2013) carried out their study on the assessment of the influence of Millennium Village Commission Programme (MVCP), a government intervention programme on sugarcane production in Nigeria: Jigawa State as case study. Data obtained from benefitting and none benefitting farmers sampled 120 and 160 respectively were analyzed using Descriptive statistics, logit regression and budgetary technique.

A study by Olatade *et al* (2016) on the manner socio-economic characteristics of farmers affects their readiness to accept biofortified cassava innovations in Oyo State. The study employed primary data which were obtained from 120 respondents selected using a multi-stage random sampling technique. Logit Regression Model result revealed that farmers' willingness to accept biofortified cassava was influenced mainly by gender. It also examined perception and determinants of rural farmers' willingness to adopt biofortified 'yellow' cassava in Oyo State, Nigeria.

Bukulo *et al*. (2015) in their study titled impact of characteristics elements on the acceptance of ginger (*Zingiber officinal*) modern production techniques in Southern Kaduna, Nigeria. The study examined the effect of socio-economic characteristics on the acceptance of modern ginger production techniques. Five out of eleven Local Government Areas Local Government Areas selected randomly due to their intensity of ginger cultivation. Forty (40) ginger farmers were purposively selected from each of the five focused Local Areas forming a sample size of 200 respondents. Data were assembled from selected ginger farmers with the aid of structured

questionnaires. The secondary data were collected from records kept by field extension workers of the Kaduna State Agricultural Development Programme (ADP) Samaru zone. The descriptive statistics were used to analyze the socio-economic and constraints of respondents while Chi-square analysis of test of relationship between farmers' socio-economic features and acceptance/adoption of modern ginger production techniques.

2.4 Empirical Review

The ideology behind the attempt to influence the socioeconomic characteristics of farmers is founded upon the obvious link between farmers' socioeconomic characteristics, and the factors affecting such, and the levels of technology adoption and productivity of the said farmers. It is then sufficing to say that extension contact and basic attribute of improved varieties/farming techniques are significant motivating factors for adoption of improved technologies amongst Nigerian farmers. The use of improved varieties of crops and modern farming techniques has also been associated with poverty reduction and food security (Johannes *et al*. 2010; Mwambu *et al*. 2008). Based on their results, these scholars argued that the extension of high yielding varieties and modern farming techniques of rice and maize in regions with high poverty constitutes an important strategy for poverty reduction and food security. In the sense of this, according to Okoruwa *et al*. (2016) extension (and advisory services), are not merely there to influence farmers physical input but more importantly to initiate a needed change in behaviour and attitudes towards the environment and relating modern inputs.

Mustapha *et al*. (2012) in their study Assessment of the Effectiveness of Lake Chad Research Institute "Adopted Villages Scheme" in the Dissemination of Improved Farm Technologies in Borno State, Nigeria using descriptive statistics and chi-square observed that there was high awareness (more than 80%) of improved technologies by respondents. Findings also revealed

that most (70%) of the respondents became aware of improved farm technologies on monthly basis. The level of participation of respondents in trial of improved technologies being disseminated was high in both the high yielding (=2.836) and early maturing (=2.60) millet varieties. Result and method demonstration was the most effective (=2.93) technique used in disseminating improved farm technologies to the respondents. The result equally indicated that result/method demonstration and farmer field school were statistically significant; X2 calculated (9.800) and (6.812) > P-value (5.991) and (5.991) respectively in effectiveness of dissemination of improved farm technologies in the study area. Lack of finance (=2.96) was the major problem affecting the effectiveness of the scheme.

Akinola *et al*. (2017) in their study on Beneficiary's Farm Income of Adopted Village intervention in Kaduna State, revealed that 89% of beneficiaries had high number of extension contacts as compared to non-beneficiaries which had no extension contact in 2011 cropping season. During the period, it was also discovered that there was statistical significant between the generated income per hectare and assets value possessed by beneficiaries.

Faborode and Ajayi (2014) in their study of the Research-Extension-Farmer-Input Linkage System for Better Communication and Uptake of Research Results in Nigerian Rural Agriculture using descriptive statistics correlation analysis and multiple regression analysis observed that most (45, 70.3%) of the technologies developed by research institutions were not known to the farmers, but remained with the researchers. Communication methods ($r = .362$; $p \leq .01$) and perception of extension workers ($r = .086$; $p \leq .05$), among others, were the correlates of REFILS' better communication of research results. The multiple regression analysis showed that age ($t = 2.073$), years of formal education of extension workers ($t = 2.808$), amount of funding ($t = 3.070$)

and farmers' frequency of contact with extension (t = 0.883) were all significantly related to REFILS' uptake of research results.

Various studies have shown that the availability and the success of the technologies, access to information on modern farming techniques and credit/hired labour are among the factors that influence farmers' adoption process in Sub-Saharan Africa. In addition, socio-economic characteristics such as extension contact, age, experience, level of education, household size, land holding and wealth are also vital determinants in the acceptance of new innovations and modern farming techniques which in turn affect the farmer's productivity (Legese *et al*., 2009; Mugisha and Diiro, 2010; Johannes *et al*., 2010; Kaguongo *et al*., 2011; Derwisch *et al*., 2011). Other studies of Kafle, (2010); Suri, (2011); and Muzari *et al*., (2012); have pointed out that farm size, farmer's learning abilities, mostly through social networks or extension contacts, observed and unobserved differences among farmers as well as across farming systems, and farmers' perception of new technologies are factors that explain the diffusion and acceptance of new innovations by farmers and in turn affects their productivity. In furtherance to this, Johannes *et al*., (2010), asserted that farmers with more land may have easier access to new technologies and the capacity to bear risk in case of technology failure.

Onumadu *et al*. (2014) in his study on determinants (Socio-economic) of acceptance of new innovations on rice in Anambra State, revealed that 80% of the farmers had 30 - 50 years of age, 75.0% were literate, 75.0% had 1 to 10 household size, 87.0% were small scale farmers, 63.3% had farming experience of 6 - 15 years and majority (73.3%) were members of Farmers' Association. This reaffirmed the result of Afolabi *et al.* (2012) which shows that the mean age of respondents was 46.8 and 48.7 years for Ekkiti and Ogun State respectively. This also entails that farmers were made up of relatively young people. Young farmers tend to be stronger, more

capable of making good production decisions and have more potential for greater productivity than old farmers, hence are likely to be more efficient in the use of production inputs than older farmers.

A study by Oyedele (2016) revealed that good education propels heads of households to adopt innovations and technologies that are vital for enhancing productivity. The level of education affects the type of decision farmers take in rice production and establishes the level of prospects accessible to increase managerial capacity and livelihood strategies in agricultural production. The finding of this study agrees with the findings of Ogundari (2006) who reported that education enhances productivity among farming households, contrary to non-educated farmers with low adoption level.

According to Jibowo (2013), majority of the rural communities are married individuals, hence their household size will contribute in some farm activities, This was further confirmed by Attah (2012) in his study on assessment of rice farmer's cooperative in Enugu state which showed that majority (88.6%) of the respondents were married, while about 9% were single and 1.4% each were widowed and divorced respectively. Accordingly, Igbaji *et al*. (2015) who posits that married farmers with their households are usually better off to adopt labour intensive farming technologies. The result indicates that number of household members has a positive influence on the output of rice farmers.

Farming experience is an important factor determining both the productivity and the production level in farming activities (Ajani, 2007). The study showed positive coefficient and statistically insignificant which means that increase in the years of farming experience led to a corresponding increase in the output of the farmers. This is in line with the priori expectation because rice farmers with high level of farming experience obtained increased yield due to higher efficiency

in resource use. They are technically, economically and allocatively more efficient than others who have low level of farming experience (Igbaji *et al*., 2015). Farm land is a very important input in agriculture and therefore, its size matters a lot in rice production. This is buttressed by Ajibefun (2016) who posited that land size is one of the indicators of the level of economic resources available to farmers and also, farmers' total farm land may be a good proxy for wealth, position and level earnings.

Attah (2012) in his study on Assessment of rice farmer's cooperative in Enugu state revealed that 77% of the respondents cultivated 2 to 3 hectares of land, while 22.9% cultivated 4 hectares and above. The mean farm size was 2.8 hectares which implies that members of cooperative society have reasonable size of land which makes them in need of cooperative society to asses' services available to member of cooperative society thereby improving their rice productivity. Membership of cooperative organization provides means of interaction among farmers which can enhance innovation diffusion easily among the farmers. According to Idiong *et al.* (2017), membership of cooperatives affords the farmers the opportunities of sharing information on modern rice farming practices. Membership of cooperatives can also enhance the accessibility of farmers to information on improved technologies, credit facilities and hired farm equipments (tractor)/labour and also serve as a medium for exchange of ideas that can improve their farm production (Oyewole, 2012).

According to Oyewole (2012), accessibility of farmers to credit facilities would increase their access to agricultural inputs which would increase food production. This was further confirmed by Okoruwa (2016) in his paper on North central rice farmer's efficiency and productivity, reiterated that accessibility to credit increases farmers' liquidity which, in turn, enhances their ability to purchase inputs and pay for hired labour and increased rice production.

Bukulo *et al*. (2015) observed the effect of farmer's characteristics factors on the acceptance of ginger (*Zingiber officinal*) improved production packages in Southern Kaduna State. 200 respondents were randomly selected for this study. Collected data using questionnaires were analyzed by descriptive and inferential statistics. The result revealed that respondent's mean age was 35.5 years, household size was 10 persons, farm size was 2.55 ha and years of farming experience constituted 15.5 years. The result also revealed that 62.70% of the respondents were married and 84.00% attained one form of education or the other. The result also revealed that educational level and scale of farming influenced the adoption of ginger farming innovations at $P \leq 0.05$. It was concluded that the level of education attained by a farmer and his/her scale of farming ease the farmers' ability to adopt improved ginger farming innovation hence a higher productivity level. It was recommended that extension agents should gear their effort towards adequate technology transfer to farmers and adequate provision of agricultural credit facilities and farm inputs to farmers at low interest rates and prices to enhance the adoption of farming technologies to boost their production capacities.

CHAPTER THREE

3.0 METHODOLOGY

3.1 The Study Area

This study was carried out in the Central Agricultural Zone 'A', Niger State. Niger State has a population of 3,954,772 people base on the 2006 census figures and is located in the North central zone along the Middle Belt region of Nigeria (Figure 1) with coordinates 10^0 $00^/$N 6^0 $00^/$E (Alamu, 2013). According to NSN (2013), the State was created on 3rd February, 1976 when the then North – Western State was transformed into Niger and Sokoto States.

Niger State can be classified among the largest States in the country spanning over 76,363 km2 (29,484 sq ml) in land area with 80% of the land mass conducive for agriculture (Tologbonse, 2008). It covers 9.30% of the total land area of the country and Agriculturally alienated into three zones: Niger State Agricultural Mechanization Development Authority Central zone 'A', North zone 'B' & South zone 'C' under climatic features containing nearly all classes of soils of the savannah regions of West Africa (Tologbonse, 2008). The Central zone 'A' of which this study was carried out comprises of eight (8) local government areas: Lavun, Gbako, Bida, Agaye, Makwa, Edati, Katcha and Lapai

The state experiences dry and wet seasons with yearly rainfall variation of 1,600 mm in the south to 1,100 mm in the north with a duration of 7 to 8 and 5 to 6 months in the south and northern zones respectively. With such a favourable climate, the state grows major crops such as rice, sorghum, maize, millet, groundnuts, cowpeas, soybeans, cotton, yam, cassava, and various vegetables. (NSN, 2013). Niger state is endowed with vast natural resources suitable for the two predominant rice production ecologies, rain-fed upland and lowland (Erestein *et al*., 2013).

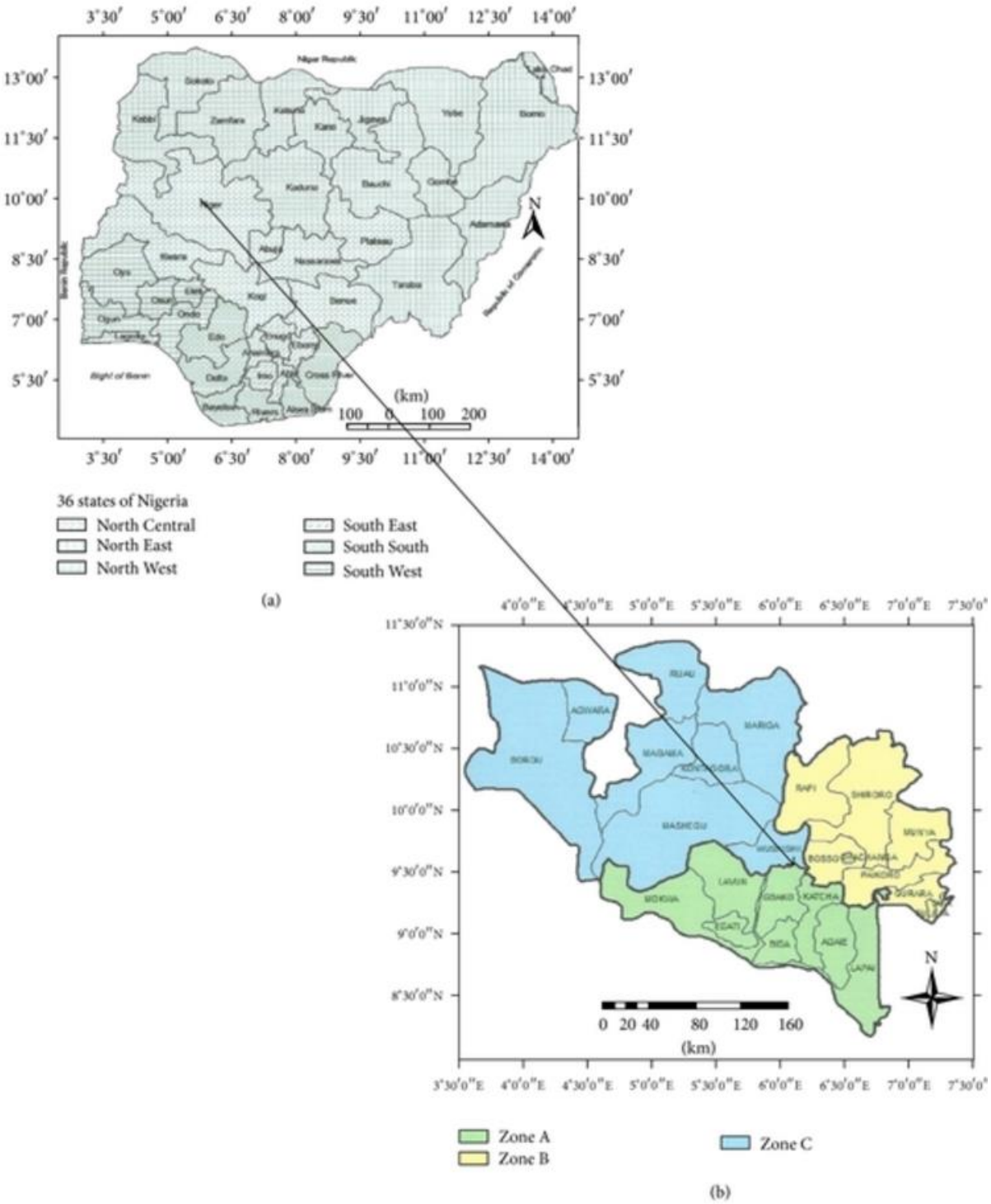

Figure 2. Map of Niger State showing the study area

3.2 Sampling Procedure and Sample Size

The Adopted villages/AROCs centres are located in Zone 'A' of Niger State Agricultural Development and Mechanization which also contains the target population of this study. The zone 'A' consists of eight (8) local government areas of Lavun, Gbako, Bida, Agaye, Makwa, Edati, Katcha and Lapai. Multi-stage sampling technique was employed with purposive selection of three LGAs where the AROC activities were very high at the Adopted village as first stage. The Local Government Areas were Lavun, Gbako and Makwa.

Six (6) farming communities, two from each adopted village/selected LGA actively involved in rice production were purposively selection at the second stage of the sampling. These farming communities were also found to be actively associated with high AROC activities in addition to their rice production active involvement within the area.

Third stage was carried out through random selection of 30 respondents out of each of the six farming communities selected at stage two, forming 180 as sample size.

3.3 Validation and Reliability of the Instrument

The Structured Interview Schedule designed was modified in line with the study's precise goals by the reviewers, Supervisor and other academic staff during the pre-data seminar organized by the Agricultural Economics and Extension Department to validate the instrument on the basis of face validity. Corrections and made for improvement were incorporated in to the instrument for data collection.

The research instrument was also subjected to test – re test method with two weeks interval on 20 respondents which represents about 10% of the total sample size for the study but entirely from outside the study location in Niger State two weeks later. The second test was carried out on the same respondents. The two set of data collection were subjected to Pearson Product

Moment Correlation (PPMC) Analysis to ascertain the reliability (r – value) of the instrument. The r – value of 0.79 was obtained. This ascertains high reliability of the instrument.

3.4 Method of Data Collection

The study employed primary data which was assembled from farming households with the aid of structured interview schedule and focus group discussions (FGD). An interview method was employed to collect data with the aid of structured questionnaire and with the help of assistants/enumerators that understand the local language. The research instrument was validated by my supervisors and experts from Agricultural Economics and Extension department to ensure that it possess the face and content validity.

3.5 Method of Data Analysis

The Organizing, summarizing and analysing of collected data were conducted using Descriptive and inferential statistical tools.

The Descriptive Statistics such as Frequency distribution, Percentage and mean will be used to achieve objectives i, ii, iii and v. Multiple Regression analysis will be used to achieve objective iv.

3.5.1 Likert Scale

Likert scale was applied to achieve objective V. It was further employed to measure degree or intensity of agreement by respondents to a statement (used to determine constraints encountered by farmers). Farmers were asked to indicate the extent of their agreement on statements using a 3- point Likert scale of Strongly Agreed (SA), Agreed (AG) and Disagreed (DA). Weight of 3, 2 and 1 were assigned. For each indicator a weighed mean obtained as follows:

$$WM = \frac{[(f\,SA * 3) + (f\,AG * 2) + (f\,DA * 1)]}{N}$$

Where:

WM = Weighted Mean, f = Frequency, Values 3,2,1 = attached weights

SA, AG & DA = Constraints of Strongly Agree, Agree and Disagree.

N = Sample size

In line with Bagheri (2010) perception analysis, the mean(s) for all indicators were categorized as follows: The mean(s) Score

1.00 – 1.49 = Disagree (DA)

1.50 – 2.49 = Agree (AG)

2.50 – 3.00 = Strongly Agree (SA)

3.5.2 Multiple Regression Model

This was used to achieve objective iv of the study. The regression equation is expressed as follows:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + U$$

Where;

Y = Level of adoption of AROC's rice production technology in percentage (%)

$$\text{Therefore, } Y = \frac{\text{Number of AROC's technologies adopted by farmer}}{\text{Total number of technologies introduced by AROC}} \times 100$$

X_1..... X_n= Explanatory/Independent variables

X_1 =Age of the farmer (years)

X_2 = Household size (number of persons in the household)

X_3 = Farming experience (years)

X_4 = Education (years of formal schooling)

X_5= Farm size (hectares)

X_6 = Marital status using dummy (if single = 0, married = 1)

X_7 = Membership of cooperatives (Member = 1, Non-Member = 0)

X_8= Training/AROC staff visits

U = Error term

b_0 = Constant term

b_1 - b_8 = Regression Coefficients

3.6 Hypothesis Testing

The study adopted Pearson correlation to test the hypothesis. From the analysis, it was observed that there was positive and significant correlation between the variables considered in the hypothesis. The default confidence interval was adopted, 95%, meaning that significance was pegged at .05%. The decision criterion is the probability (p) value relative to the significance of associations at 0.05 level of significant, where all hypotheses are stated in the null and alternate form.

Going by this the two null hypotheses were rejected and the alternative hypothesis are given thus:

H_{A1} = there is significant relationship between the socio-economic characteristics of rice farmers and their rate of adoption of AROC's introduced innovations/modern production techniques on rice in the study area.

H_{A2} = there is significant difference between the effects of respondent's socio-economic characteristics and their rate of Adoption of AROC's introduced innovations/modern production techniques on rice in the study area.

Table 3.1: Adoption rate of AROC's introduced Innovations on Rice Production

Correlations

		LOA	AGE	MS	SCH	FSIZ	FEXP	FLS	CMP	STV
LOA	Pearson Correlation	1	-.028	.012	.043	-.174*	-.100	.102	-.066	-.085
	Sig. (2-tailed)		.712	.883	.569	.019	.189	.197	.375	.257
	N	180	180	165	180	180	174	161	180	179
AGE	Pearson Correlation	-.028	1	-.219**	-.365**	.612**	.568**	.590**	.045	.165*
	Sig. (2-tailed)	.712		.005	.000	.000	.000	.000	.552	.028
	N	180	180	165	180	180	174	161	180	179
MS	Pearson Correlation	.012	-.219**	1	-.042	-.221**	-.167*	-.041	-.147	-.109
	Sig. (2-tailed)	.883	.005		.590	.004	.035	.620	.059	.166
	N	165	165	165	165	165	159	146	165	164
SCH	Pearson Correlation	.043	-.365**	-.042	1	-.325**	-.466**	-.374**	.108	.062
	Sig. (2-tailed)	.569	.000	.590		.000	.000	.000	.150	.413
	N	180	180	165	180	180	174	161	180	179
FSIZ	Pearson Correlation	-.174*	.612**	-.221**	-.325**	1	.615**	.662**	-.075	.203**
	Sig. (2-tailed)	.019	.000	.004	.000		.000	.000	.316	.006
	N	180	180	165	180	180	174	161	180	179
FEXP	Pearson Correlation	-.100	.568**	-.167*	-.466**	.615**	1	.610**	-.029	.011
	Sig. (2-tailed)	.189	.000	.035	.000	.000		.000	.700	.886
	N	174	174	159	174	174	174	157	174	173
FLS	Pearson Correlation	.102	.590**	-.041	-.374**	.662**	.610**	1	-.149	.052
	Sig. (2-tailed)	.197	.000	.620	.000	.000	.000		.059	.511
	N	161	161	146	161	161	157	161	161	161
CMP	Pearson Correlation	-.066	.045	-.147	.108	-.075	-.029	-.149	1	-.091
	Sig. (2-tailed)	.375	.552	.059	.150	.316	.700	.059		.227
	N	180	180	165	180	180	174	161	180	179
STV	Pearson Correlation	-.085	.165*	-.109	.062	.203**	.011	.052	-.091	1
	Sig. (2-tailed)	.257	.028	.166	.413	.006	.886	.511	.227	
	N	179	179	164	179	179	173	161	179	179

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Respondent's Socio-economic Characteristics

In order to provide valuable information on the respondents, its one of the cardinal objective of this research work to explain their socio-economic characteristics. The socio-economic variables were: Age, education level, Farming experience, Farm size, Marital status, Annual income from rice production, Credit received for rice production, Number of Extension visits/annum to famer's farm, Number time Famer's attends AROC activities/year, Number times farmer attends training/season, Membership of cooperative society and years spent as member of such cooperative society/association.

Respondent's Age: Table 4.1 shows 74.4% (majority) were between the age bracket of 41 – 60 years. Respondents between the ages of 21 and 40 years and those above 60 years of age both accounted for 12.7% respectively. The insinuation of this result means farmers in the age bracket of 41 – 60 years fall within the middle age group, who were still energetic and productive. The mean age of respondents was 50 years. This discovery is supported with those of Mustapha *et al.* (2012) and Matanmi *et al.* (2011) in their study on Perceived factors limiting rice production in Patigi Local Government Area, Kwara State, Nigeria. They reported that the farmers involved in rice production, majority of them were within the middle age group who were energetic and highly productive. The respondent's mean age was 50 years. This finding agrees with that of Hayrol *et al*. (2009) in his work on the Level of Agro-based Website Surfing among Malaysian Agricultural Entrepreneurs, who revealed the farmer's average age to be in excess of 46 years for developing countries.

Marital Status: Table 4.1 indicated that majority (97.7%) of the farmers were married, while about 3.3 percent were unmarried. This implies that the married families were more involved in rice production than the unmarried ones. The result also inferred that more members of farm family in the study area are likely going to be available for rice production. The result further conforms with that of Ayoola *et al.* (2011) who studied factors (socio-economic) influencing rice production among farmers in Nigeria and Matanmi (2011) assessing the perceived factors limiting rice production, Patigi, Kwara state, who suggested that majority of farmers had stable family which would enrich decision-making process especially in rice technology adoption, production and domestic responsibilities.

Level of Education: Table 4.1 results shows that 54.3% (majority) of the respondents had no formal education, 20.5% of the respondents had primary education while 17.7% obtained secondary education and 7.2% acquired tertiary education. The findings further show that even though the educational level of the respondents was low, there may be a likelihood of effective interaction amongst farmers with no formal education, those with formal education and AROC staff/extension agents which enhanced the level of understanding and desirability of adopting new farm technologies by respondents. The allusion of this verdict was that with proper advisory services and good follow up trainings farmers, notwithstanding their educational status, can access and incorporate necessary innovations into their agricultural practices.

Farming Experience: Table 4.1 shows that majority (76%) of the famers had between 1 – 10 years farming experience and 23.8% had 11 – 20 years with mean value of 7 years farming experience. Findings also show that smallholder rice farmers in the study area had relatively moderate experience in rice production which may likely to contribute to the awareness/familiarity and adoption of AROC introduced rice production technologies. Although,

farming experience has been reported to improve adoptiveness of farmers the fact that the population was mostly young will contribute in increasing receptiveness of farmers to new technologies.

Farm Size: The result in Table 4.1 show that majority (98.8%) of the respondents had between 1 – 5 hectares of rice farm land and only 1.2% had 6 – 10 hectares. The mean farm size was 2.5 ha. This shows that the respondents were mainly smallholder rice famers in the study area. This finding might be connected with the fact that farm acquisition in the area was virtually through inheritance and continued fragmentation of big farms into small plots amongst the family members. This result corresponds with the findings of Mustapha *et al*. (2012) and Fakayode (2009) which both indicated that majority (61.25%) of the respondents had 1-3 hectares of rice farms. It also agrees with Fasasi (2010) in his work on Resource-use efficiency in Yam production in Ondo State, who reported that highest percentage of food produced in Nigeria was produced by small scale famers.

Farm Land Acquisition: Table 4.1 shows that majority (71%) of the respondents acquired their farmlands through inheritance, 23.9 percent through rent/lease, and 3.4 through purchase while 1.7 percent of the respondents acquired their farmlands through communal effort. The result indicated that no change has taken place in method of land acquisition over the years. This also underscores the near absence of land markets in most states of Nigeria. The result also justified the consistent farm land fragmentation into smaller farms that exist in Nigeria. The findings agree with the known fact that Nigerian agriculture is dominated by ageing population who are small scale famers that largely acquired their productive farm lands through inheritance.

Household Size: Table 4.1 indicated that majority about 63.3 percent of farmers in the study area had 1-10 persons as household size and were mostly used for farm family labour.

About 33.8 percent had family size within 11- 20 households, 2.7 percent had within 21-30 household members. This indicated a fairly large household of the majority of respondents which might argument any short falls in terms of farm labour supply. According to Onumadu (2014) who discovered in his work that polygamous nature of the rural farmers was instrumental to large family size. He further opined that majority of farmers in the rural areas believed that large household size is an economical way to take advantage of farm income using family labour. The finding also agrees with Igbaji *et al*. (2015) who revealed in their study that married farmers with good households size are usually better off to adopt labour intensive farming technologies and hence a positive influence on the output of rice farmers.

Annual Income from Rice Production: Greater proportion (46%) of the respondents as indicated on Table 4.1 had an annual income between ₦201,000 – 300,000 and 40.5% of the respondents earned annual income of between ₦101,000 – 200,000. The findings also revealed that the current annual income with average mean of ₦250,000 was due to the adoption of improved innovations on rice production introduced by AROC as income prior to adoption was markedly lower. This was supported by Ojo *et al.* (2013) who revealed that access and adoption to improved technologies, agronomic practices of staple crops will result to increase in the efficiency and income generation. This result also agrees with that of Johannes *et al*. (2010) on implications for poverty reduction and Adoption of maize and cassava production techniques in the forest-savannah zone of Cameroon. Its also in line with Mwambu *et al*. (2008) in their study on 'Does adoption of improved maize varieties reduce poverty?:Evidence from Laikipi and Suba districts in Kenya' opined that the adoption of improved varieties of crops and modern farming techniques had the potential of increasing incomes that will lead to stable income and poverty reduction.

Number of Extension Visits received per year by respondents: Table 4.1 indicated 56.7% (majority) of the farmers interviewed had their farms visited 6 to 10 times per annum by the AROC staff or extension agents. The result revealed that majority of the famers had their farms visited more often with an average mean of 7 times and such contacts afforded farmers the opportunity of sharing ideas and information on modern rice production practices which may likely lead to high level of adoption of these technologies. The finding corresponds with that of Jamilu *et al.* (2016) and Namwata *et al.* (2010) who reported that increased extension contact was positively and significantly associated with overall acceptance of new agricultural innovations among farmers.

Number of trainings attended per annum: Table 4.1 shows that majority of about 72.8% of the respondents attended the AROC organized training between 1 to 3 times per session, 26.7% attended between 4 – 6 times. The mean for attendance of AROC's training is 3 times. The result revealed that a good number of smallholder farmers in the area benefited from the various AROC training activities which enhanced their skills and knowledge on modern agricultural practices and consequently affects their outputs. This result agrees with Issa *et al*. (2017) in their research on Institutional features inducing Acceptance of Recommended Agrochemical Practices by Crop Farmers in Nigeria, posited that training is the means through which the farmer can equip themselves with the latest knowledge regarding agrochemical practices. The finding also portrays the recommendation made by Tsodo *et al.* (2014) in which they suggested that top most priority should be accorded to regular training of farmers on rice production, in order for them to obtain optimum yield from the adoption of new innovation packages of rice production.

Membership of cooperative society

Table 4.1 shows that majority (90%) of respondents belong to one cooperative society or the other. On the other hand table 4.1 also revealed that about 77% had spent between 4 to 7 years as members of such societies. The mean years of being a member of one cooperative society or another is 4.5 years. This result shows high level of enlightenment amongst majority of the respondents on the benefit of being member of cooperative societies. The implication is that farmers who are members of the farmers' association/cooperative have higher probability of adopting AROC introduced technologies. This is because of high level of interaction among members of the same group is a means of disseminating innovation to the members. Farmers groups are sources of inputs to farmers and also exert peer influence on members to adopt innovation. This finding it agrees with that of Amaza *et al.* (2009) who revealed that membership of cooperatives influences adoption of improved technologies resulting in higher productivity and improve standard of living. This also was in line with the result of Bello *et al.* (2012) who posited that accessibility to information on improved agricultural production and modern farming techniques are enhanced by being member of cooperative groups/association and hence increases level of adoption of such innovations/technologies.

Table 4.1: Socio-economic Characteristics of Respondents

Variables	Frequency	Percentage	Mean
Age (years)			
21 – 40	23	12.7	
41 – 60	134	74.4	50 yrs
Above 60	23	12.7	
Marital Status			
Single	6	2	1
Married	174	97	
Educational Qualification			
No Formal Education	98	54.3	
Primary Education	37	20.5	
Secondary Education	32	17.7	
Tertiary Education	13	7.2	
Farming Experience (Years)			
1 – 10	137	76	
11 – 20	43	23.8	7 yrs
Above 20	-	-	
Farm Size (Hectares)			
1 – 5	178	98.8	
6 – 10	2	1.2	2.5 ha
Above 10	-	-	
Farm Acquisition			
Inheritance	128	71	
Communal	3	1.7	
Purchase	6	3.4	
Rent/Lease	43	23.9	
Household Size			
1 – 10	114	63.3	
11 – 20	61	33.8	8
21 – 30	5	2.7	
Above 30			
Annual Income from Rice Production (₦)			
1,000 – 100,000	18	9.9	
101,000 – 200,000	74	40.5	250,000
201,000 – 300,000	83	46	
301,000 – 400,000	7	3.8	
401,000 – 500,000	-	-	
Above 500,000	-	-	
Credit/Loan for Rice Production			
Accessed/Collected	59	32.8	
Not collected	121	67.2	
Number of Extension visits/Year			
1 – 5	57	31.7	
6 – 10	102	56.7	7
11 – 15	21	11.6	
Number of Attendance of training/Year			
1 – 3	131	72.8	
4 – 6	48	26.7	3
7 – 9	1	0.5	
Membership of Cooperative Societies			
Member	169	90.6	1
Non-Member	17	9.4	
Years spent as Member of Coop Societies			
0 – 3	37	20.6	
4 – 7	139	76.7	4.5
8 – 11	4	2.2	

Source: Field Survey (2018)

4.2. Sources of Information on Rice Production frequently used by Respondents

The most important targets of information sources were to generate consciousness through disseminating useful and practical information on new innovations on rice production among potential adopters thereby encouraging famers to accept such innovations. The most effective information sources on rice production used frequently by the respondents as revealed in table 4.2 were extension agents from both AROCs and ADP (98.8%) and followed by fellow farmers with (45.5%). These two highly rated sources of information could be portrayed as individual information sources. The results therefore deduce that personal or individual sources of information such as extension agents/AROC staff was efficient in spreading complex information such as innovation packages on rice production and identified as the most frequently used source of information by farmers. The conduct of AROC activities in the area as revealed by this study might have contributed to the increase interactions amongst farmers led to the second most frequent source of information (fellow farmers). The study also shows that the purposes for utilization of the available information sources and services are directly associated with knowing how to treat pests, diseases and improved seedlings and knowledge on new agricultural innovations which could best be obtain from extension agents. Akanda and Roknuzzaman (2012) in their publication Agricultural Information Literacy of Farmers noted that the most significant purpose for sourcing agricultural information by the farmers were for advancement of primary production of agriculture, producing quality product and products planning, achieving sustainable agriculture, marketing agricultural product and controlling pests.

Table 4.2 also shows that hybrid media was the less frequently used (1.1%) source of information on innovations of rice production in the study area. The result indicated low knowledge or utilization of ICT tools for information dissemination on innovation packages of rice production.

Table 4.2: Distribution of Famers according to Information Sources on Rice Production

Source	Frequency	Percentage (%)
Extension Agents (AROC and ADPs)	178	98.8
NGOs	23	12.7
Radio	36	20
TV	7	3.8
Hybrid Media (GSM & Internet)	2	1.1
Input Dealers	32	17.7
Fellow Farmers	82	45.5
Cooperatives/Associations	16	8.8
Others	6	3.3

Source: Field Survey (2018)
Note: Multiple choices were allowed

4.3. Rate of Adoption of AROC's Introduced Rice Production Technologies

Table 4.3 shows that eleven (11) improved technologies out of twenty-six (26) technologies introduced by AROC had very high adoption rate (80 - 100%) and seven (7) technologies had high rate of adoption (60 -79) in the study area. The seed varieties with very high adoption rate in the study area were NERICA 1 (Upland) and FARO 44 - sippi (Lowland) which may likely be due to their high yield and market value. This finding agrees with that of USAID (2010) in their report on Improved packages of practices for rice production in Nigeria, asserted that Nigerian market recommends FARO 44 (sippi 692033) and FARO- 46 (ITA150) and NERICA 1 varieties for Upland based on the demonstrated evidence of high yield by research institutes and the outcome of project intervention in the previous years. The results also show that more than half of the technologies had their rate of adoption exceeding 60 percent. The result further indicated that majority of farmers had higher adoption level in the study area which may in turn lead to increase in rice production and improved standard of living of the famers. The result further portrays that rice farmers in the study area were less resistance to new technologies despite their low level of education, which may likely to be due to contributions of AROCs in the study area.

Tadesse (2010) in his study reported that in order to enhance agricultural productivity through adoption of innovations, the farmers' required good facilitation and sufficient utilization of well-organized and relevant agricultural information.

Table 4.3: Rate of Adoption of AROC's Introduced Rice Production Technologies

Technologies	Number of Famers	Rate of Adoption (%)
NERICA 7 (Upland)	123	68*
NERICA 1 (Upland)	172	95**
NERICA (Upland)	15	8.3
FARO 44-sipi (Lowland)	146	81**
FARO 52 (Lowland)	125	69*
FARO 60 (Lowland)	118	65*
Improved Land Preparation	41	22.7
Dibbling Planting Method (Upland)	143	79*
Drilling Planting Method (Upland)	57	31.6
Broadcasting Method (Upland)	22	12.2
Transplanting after sowing in Nursery (Lowland)	168	93**
Transplanting 2 – 3/hill (Lowland)	157	87**
Optimum sowing date (Upland) May – June	33	18.3
Optimum sowing date (Lowland) June – July	168	93**
Recommended Fertilizer best practices	165	91**
Proper use & type of Herbicides	163	90**
Improved Harvesting techniques	17	9.4

Source: Field Survey (2018)

Note: ** = Very High rate of Adoption (80 – 100%) * = High rate of Adoption (60 – 79%)

4.4. Effects of Respondents' Socio-economic characteristics on their rate of Adoption of AROC's Rice Production Technologies

Table 4.4 shows the regression analysis of the effects of respondents' socio-economic characteristics on their rate of Adoption of AROC's Rice Production Technologies. The R-squared (R^2) shows that the 84.99% in variation in the output was explained by variables contained in the model; this shows best fit of the model. Table 4.4 shows that the coefficient of Age (t= -3.88), Farming experience (t= -3.121), Education level (t = 8.20) and Extension visits (t = 5.074) were significant at 1% while Farm size was significant at 10% probability level. The table also indicated that marital status, family size and cooperative membership were not significant.

Number of extension visits to famers' farms had a positive and significant relationship with the level of acceptance of technologies introduced by AROC programme at 1%. This posits that for any additional number of extension visits will also increase the rate of adoption of AROC introduced rice production technologies hence number of extension visits has influence on the rate of adoption. The study revealed that number of extension visits to farmers' farms and farmers' visits to demonstration plots/AROC centre increases confidence and knowledge of farmers towards technologies that were offered, thereby increasing the rate of adoption of new technologies. The result agrees with Ayoola (2012) and Nyanga (2012) and also the finding of Bello *et al*. (2012) in their study on investigation of features influencing the continuation of acceptance of innovations with some Nigerian farmers. They concluded that the increasing in number of attendances in an extension programme effect significantly positive on the application of agricultural technology. This was further supported by Okoruwa *et al*. (2016) who opined that extension (and advisory services), were not merely there to influence farmers physical input but

more importantly to initiate a needed change in behaviour and attitudes towards the environment and relating modern inputs.

The coefficient of the variable (years spent in school) is positively significant at 1%. This entails that the more the educational level of the farmers the more they adopt AROC's introduced rice production technologies. The result indicated that farmers with relatively higher educational level are more likely to have better education and higher adoption of improved innovation packages of rice production. The result of this study agrees with that of Oyedele (2016) who studied on economic analysis of irrigated rice production in Kura LGA of Kano State revealed that good education propels heads of households to adopt innovations and technologies that are vital for enhancing productivity. The finding of this study also agrees with Xu and Wang (2012) factors affect Chinese producer's adoption of a new production technology: Survey result from Chinese fruits producers; and that of Sigha *et al*. (2012), analysis on influence factors of technology adoption of different land based enterprises. They posited that the level of education affects the type of decision farmers take in rice production and agree on the level of available opportunities to increase managerial capacity and livelihood strategies in agricultural production. The result was contrary to the findings of Issa *et al*. (2016) on analysis of farmers adoption of improved maize production, Ikara, Kaduna State, Nigeria. It revealed that adoption of new maize production practices was irrespective of the level of education and farming experience.

Age has a statistically negative significance toward the rate of adoption of AROC introduced technologies, at 1%. This means that the elderly the farmer, the less likely the rate of adoption of AROC's introduced rice production technologies. It also revealed that Farmers that were older in the study area were more likely to be reluctant to adopting new techniques, they were more

prone to maintaining the customs that had existed previously and that they were used to. The result agrees with the Paxton *et al*. (2011) findings and that of Moga *et al*. (2012). They both revealed that age was negatively correlated with the adoption and application of new innovations on agricultural production. The findings also agree with Afolabi *et al* (2012) who revealed that Younger farmers adopt new technology faster.

The result further showed that farming experience was significant at 1% and has negative value of regression coefficient which indicates that adoption was inversely related to rice farming experience. The finding revealed that as the farmers get older, they become more averse to risk taking. Therefore, the more the number of years in farming the less likely the adoption of AROCs introduced rice production technologies. The result agrees with Ajani (2009) in his study which opined that farming experience was an important factor determining both the adoption, productivity and the production level in farming activities. The result might likely to be in line with the priori expectation that rice farmers with high level of farming experience obtained increased production not necessarily because of higher adoption level of new technology but due to higher efficiency in resource utilization. This finding was contrary with that of Ainembabazi *et al*. (2014) suggested that in early stages of adoption of a given innovation when farmers are still testing potential benefits, farming experience was useful which later determines its retention or rejection over time.

The result on table 4.4 further shows that, the farm size coefficient is significant at 10%. This indicated that the bigger the farm land the more likelihood to high adoption of AROC's introduced rice production technologies. Therefore, as the farm size raises, the probability of acceptance/adoption of new innovations increases, thereby increasing production volume and

income of farmer. This finding was supported by previous studies of Ayoola (2012); Nyanga (2012) and Bello *et al*. (2012). They suggested that the Farm size has positive and significant effect on the adoption of new innovations. The result was also in line with the findings of Johannes *et al*., (2010) who asserted that farmers with more land may have easier access to new technologies and the capacity to bear risk in case of technology failure. However, this verdict negates the pronouncement of Idris *et al*. (2012) that farm size had nothing to do with adoption of new technologies.

The study however, revealed that Family size and Cooperative membership of the smallholder rice farmers were found to be not significant to the level of adoption of technologies introduced by AROC

Table 4.4: Regressions Results of Socio-economic Effects on Adoption of AROC's introduced Rice Production Technologies

Variable	Coefficient	Std Error	t-Statistic	Probability
Constant	0.598931	0.073543	8.143904	0.0000***
Age	-0.003081	0.000794	-3.881772	0.0001***
Coop. Membership	0.022148	0.016453	1.346150	0.1800^{NS}
Faming Experience	-0.006227	0.001995	-3.121843	0.0021***
Household Size	-0.005678	0.004531	-1.253169	0.2119^{NS}
Farm Size	0.013815	0.007032	1.964638	0.0511*
Marital Status	0.005116	0.033419	0.153096	0.8785^{NS}
Yrs of Schooling	0.010309	0.001257	8.201990	0.0000***
Number of Extension Visits	0.016251	0.003202	5.074713	0.0000***

R^2 = 84.99%

Note: *** = Significant at 1%
** = Significant at 5%
* = Significant at 10%
^{NS} = Not significant.

Source: Field Survey (2018)

4.5 Adoption Constraints to AROC's introduced innovation on Rice Production

Table 4.5 shows the result of constraints to the acceptance AROC's introduced rice production technologies that respondents encountered the in the study area. The constraints according to the order of prevalence were Lack of accessibility of Hybrid Media (2.9), inadequate Capital (2.7), Inadequate access to input (2.4) and Inadequate Farm Land (2.3) were leading constraints to acceptance of rice innovations in the study area. This result was in line with some studies including Salleh *et al*. (2009) on internet users among agro – based entrepreneurs; Hayrol *et al*. (2009) and Abu *et al*. (2009). They both advanced that factors such as inadequate capital and farm land, lack of infrastructural facilities such hybrid media facilities, negative perceptions, and inadequate human capacity of extension workers were key drivers to low acceptance of technologies.

The implication of inadequate capital, strongly agreed by respondents as serious constraint in this study could also be the likely factor for inadequate access to input and farm land due to insufficient purchasing power which possibly leads to low rate of adoption or discontinuation of rice production technologies among respondents. This finding agrees with that of Adebisi *et al*. (2011), assessing awareness and usage of horticultural technologies in selected adopted villages of South Western Nigeria, reported that the major constraints to dissemination and adoption of improved technologies were inadequate capital, farm land and lack of access to inputs encountered by famers.

Lack of accessibility of hybrid media was also identified as strongly agreed by respondents' in the study area. This circumstance imitate that Nigeria requires to catch the attention of more young people and retain them within the agriculture community using hybrid media as they constitute the larger part of literate the literate and can incorporate information derived from that source more easily into their production process. The true value of hybrid media was noted by

Mishra and Williams (2010) in one of their paper on internet access and utilization by farm households, AAEA Annual Meeting, Long Beach, Carlifornia.

The constraint of lack of adequate farm lands agreed by majority of the respondents with weighed mean of 2.3 could hinder adoption of improved technologies due to the fact that they might not be ready to take risks of trying new production technologies, hence averse to risk taking. This finding agrees with Johannes *et al*. (2010) who asserted that farmers with more land may have easier access to new technologies and the capacity to bear risk in case of technology failure. In a similar finding Abu *et al.* (2011) in their study titled "Analysis of socioeconomic features influencing the acceptance of innovations on rice, Borno State'' posited 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.

Table 4.5: Constraints to the Adoption of AROC's introduced Rice Production Technology:

Constraints	**Mean Score**
Inadequate information about Technologies and its benefits	1.0
Weak social Network	1.7
Poor delivery of extension services	1.2
Lack of proximity of AROC centres	1.4
Technologies perceived to be less advantageous	1.0
Technologies perceive to be highly complex	1.2
Inadequate farm land	2.3*
Inadequate capital	2.7*
Poor access to improved Inputs	2.4*

Source: Field Survey, 2018
Mean Value = 2 (since 3-point Likert was used)
Note: Any Mean Score equal to or greater than 2 ($X \geq 2$) is serious constraints and marked (*)

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The research work assessed the rate of adoption of rice production innovation packages introduced by the Agricultural Research Outreach Centres (AROCs) in the Central Agricultural Zone 'A' of Niger state. Multi-stage sampling technique was employed with first stage purposive selection of three LGAs that involved Lavun, Gbako and Makwa with very high AROC activities. 180 respondents were randomly selected from six communities, two from each of these three LGAs (Ndabachi, Dabarako, Emitsun-dadan, Lemuta, Dwarfu and Aye).

Primary data were collected from 180 rice farming households with the aid of structured interview schedule and focus group discussions (FGD). The analytical tools used to analyse the data were Descriptive Statistics (Frequency distribution, Percentage, Likert scale) and Multiple Regression analysis. The descriptive analysis of the sample famers was done to understand and explain the socio-economic features of the rice famers influencing the rate of adoption of AROC's introduced rice production innovations in the study area.

The result revealed that the respondent's mean age of was 50 years and majority (97.7%) of the respondents were married. Majority (54.3%) of the respondents had not attend any formal education. This further shows that even though the educational level of the respondents was low, there may be a likelihood of effective interaction amongst farmers with formal education, the AROC staff/extension agents and those with no formal education which enhanced the level of awareness and desirability to adopt new technologies by respondents in the stud area. Majority (76%) of the famers had between 1 – 10 years farming experience with a mean value of 7 years. The findings show that the respondents had relatively moderate experience in rice production

which proved the fact that the population was mostly young/middle age and had contributed to the increase in receptiveness of farmers to new technologies introduced by AROC.

The farm size of majority (98.8%) of respondents ranged between 1 – 5 hectares with an average of 2.5 ha. Majority (71%) of the respondents acquired their farm lands through inheritance. The household size of the majority (63.3%) of the respondents had between 1 – 10 persons and 33.8% having 11 – 20 family members.

Majority of the rice famers (50.5%) attended AROC training activities between 7 to 9 times per season. The results indicated that about 56.7% of the respondents had their farms visited 6 to 10 times per annum by the AROC staff or extension agents. A greater proportion of the respondents (46%) incurred over 201,000 – 300,000 Naira and 40.5% of the respondents earned annual income of between 101,000 – 200,000 Naira as income per annum from rice production. The study also indicated that 67.2% (majority) of the rice farmers had no access to credit. Majority (90.6%) of the respondents belongs to one cooperative society or the other and about (76.7%) had spent between 4 to 7 years as members of such societies.

The sources most frequently used by the respondents to acquire information on rice production in the area under study was extension agents and farmer contact (AROCs and ADPs) which was ranked first (1^{st}) and followed by the fellow farmers which ranked second (2^{nd}). Furthermore, about 42% of group of respondents had the highest adoption rate of 61 – 80 percent followed by group of respondents (41.6%) ranked 2^{nd} with adoption rate of 41 - 60 percent. Therefore, majority of famers in the study area had adopted new technologies and modern agronomic practices which had in turn led to increase in rice production and improved standard of living.

The socio-economic characteristics affecting the rate of adoption of AROC's introduced rice production technologies found to be significant were: Age (t= -3.88), Farming Experience (t= -3.121), Educational level/years spent in school (t = 8.20) and AROC Staff visits (t = 5.074), were all significant at 1% level while Farm size (t = 0.0511) was significant at 10% probability level. The major constraints identified were Inadequate Capital (2.7), Lack of accessibility of Hybrid Media (2.9), weak social network (1.7), inadequate access to input (2.4) and Farm Land (2.3).

5.2 Conclusion

It can be concluded that the adoption rate of AROC's (Agricultural Research Outreach Centres) introduced innovation packages on rice production in the study area were determined by socioeconomic features of rice farmers such as Age, educational level, prior farming knowledge, and number of AROC's staff visits to farmer's farm. In line with the results also most of the respondents had high adoption rate for the various improved rice production technologies introduced to them by AROCs despite the low educational level of the farmers and fragmented farm lands in the study area. This was conclusively due to vigour, profound exposure to nitty gritty of the technologies a result of consistent AROC staff visits/extension services and hands-on-oriented training to the farmers in the study area.

5.3 Recommendations

i) Inadequate Capital was identified as serious constraint towards acceptance of innovation packages on rice production in area under study which might had been as a result of poor access to credit. Therefore, it is recommended that financial institutions such as Bank of Agriculture (BOA), Commercial Banks and relevant financial regulatory agencies such as Central Bank of Nigeria (CBN) should assist in providing flexible, low-interest credits and removal of stringent

conditions attached to credit access. This would increase the purchasing power of the rice farmers to boost their productivity.

ii) The study shows that hybrid media was a serious limitation towards the acceptance/adoption of rice production innovations. Therefore, effort should be made by concern organizations to ensure adequate provision of required ICT tools and trainings are made to extension service providers to effectively improve communication channels for dissemination of modern agronomic practice and extension packages timelier and easily accessible to targeted farmers.

iii) The findings also show that inadequate farmland was agreed by the respondents as a constraint to acceptance of new innovations on rice production. It's therefore recommended that government should enact and implement policies that would provide easy access to land and ensure gender biases in access to farm land. These would ensure availability of rice farm lands as it was discovered by this study, farmers that possess larger farms might likely stands to have high level of adoption of agricultural innovations and also most likely to remain adopters.

iv) Inadequate input (such as fertilizer, tractors etc) was discovered as one of the constraints for the adaption of rice production innovations in the area under study. It is therefore recommended that AROC programme and other extension providers should facilitate linkages of farmer's organizations with appropriate sources of farm inputs and also encourage the community on the importance of emergence of farm input service providers in the area.

v. Incorporation of innovations and new technologies by farmers have proved to be the key to raising farmers' productivity levels, therefore government and relevant stakeholders should prioritize establishment of the best extension teaching methods and systems as well as

administration to help increase rate adoption of innovations and sustainability of the use of these technologies over time.

vi. More villages should be selected with partnership between government and the private sector in order to cover more grounds and encourage farming communities towards large scale adoption of new agricultural innovations.

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APPENDIX 1

NASARAWA STATE UNIVERSITY, KEFFI, NASARAWA STATE, DEPARTMENT OF AGRICULRURAL EXTENSION AND ECONOMICS.

Farmer's Questionnaire

Dear Respondent,

I. Mr. **Nuhu Yusuf**, a masters' student of the above named department from Nasarawa State University, Keffi, Nasarawa state carrying out a research project.

This questionnaire is meant to help me collect data and information that are necessary for the successful completion of this research work, and you have been selected as one of the respondents.
All information provided by you is purely for academic purpose and am assuring you that it will be treated confidentially.

Thanks for your anticipated cooperation.

.

Yours Truthfully,
Nuhu Yusuf
Research Fellow

QUESTIONNAIRE SCHEDULE

ANSWER ALL QUESTIONS AND TICK (√) IN THE APPROPRIATE SPACE PROVIDED

I. Name of farmer /phone No.…….

II. Zone: ……..…….

III. Local Government Area: …….

IV. Adopted Village: …….……

V. Farming Community: …….……

SECTION A: Data on Socio- Economic Characteristics of Smallholder rice Farmers

1. Gender: (a) Male [ ] (b) Female [ ]
2. Age (years)…….....
3. Marital status: (a) Married [ ] (b) Single [ ] (c) widowed [ ] (d) Divorced [ ]
4. Educational Level or qualification: (a) Non Formal Education [ ] (b) Primary Education [ ] (c) Secondary Education [ ] (d) Tertiary Education [ ] (e) Skill acquisition [ ]
5. How many years did you spend on formal schooling ? …….
6. Farm Size (ha): (a) ≤ 1.0 [ ] (b) 1.0-1.9 [ ] (c) 2.0-2.9 [ ] (d) 3.0-3.9 [ ] (e) 4.0 and above [ ]
7. Farming Experience (years): (a) 1 – 5 [ ] (b) 6 – 9 [ ] (c) 10 – 14 [ ] (d) 15 – 19 [ ] (e) 20 above [ ]
8. Family size (in numbers): (a) 1 – 2 [ ] (b) 3 – 5 [ ] (c) 6 – 8 [ ] (d) 9 – 12 [ ] (e) 12 above [ ]
9. How did you acquire your farmland ? (a) Inheritance [ ] (b) Communal [ ] (c) Purchased [ ] (d) Rented Leased [ ] (e) Others (Specify) ……
10. State your Annual Income from rice production: ₦……..
11. Do you belong to any farmer's Association / Cooperative group? Yes [ ] No [ ]
12. If Yes, how long (years) have you been a member of such group? ……..
13. Have you ever attended any training on rice production? Yes [ ] No [ ]
14. If Yes, how many times did you attend such training?.....
16. Have you ever obtained loan for rice production in the past five years? Yes [ ] No [ ]
17. If Yes, state the total amount of loan obtained during the period: ₦……..

18. How many times do you receive extension visit in a year?.....

SECTION B: **Sources of Information on Rice Production Technologies**

1. Are you aware of existence of AROC Centre? Yes [ ] No [ ]
2. Do you have Extension Agent Contact Yes [ ] No [ ]
3. Do you frequently get information on Rice Production Yes [ ] No [ ]
4. If Yes, through which sources of information:

- AROC Centre`s activities [ ]
- ADP Extension Staff [ ]
- NGO services [ ]
- Input Providers [ ]
- Farmers organizations/Cooperative [ ]
- Peer / other farmers [ ]
- Radio [ ]
- Television [ ]
- GSM Phone [ ]
- Internet [ ]
- Others (please specify):……

5. State the number of times you attended activities at AROC centre last season: None [ ] Once [ ] Twice [ ] Trice [ ] four times [ ] five [ ] More than five times [ ]
6. State the number of times AROC`s Staff visited your farm? None [ ] Once [ ] Twice [ ] Trice [ ] four times [ ] five [ ] More than five times [ ]

SECTION C: Level of adoption of AROC`s introduced rice production technologies

1. Indicate whether you are aware or have adopted any technologies introduced by AROC centre

S/N	Technologies	Aware	Not Aware	Adopted	Not Adopted	Adopted for how long (years)
1.	Upland rice varieties: a) NARECA 7 b) NARECA 1 c) NARECA					
2.	Lowland rice varieties: a) FARO 44(sipi) b) FARO 52 c) FARO 60					
3.	Land preparation: a) Improved Manual b) Improved Mechanical					
4.	Planting: a. Improve Sowing Method (up land): Dibbling Drilling Spreading b. Improve Sowing (Low land): Transplant after sowing nursery Transplant 2 – 3 seedlings/hill c. Optimum Sowing dates:					

	May – June (up land) June – July (Low land):					
5.	Fertilizer application: a) Recommended application b) Time of application c) Recommended Dosage applied					
6.	Weed control: a) Improved Manual b) Proper use and type of herbicide					
7.	Improved Pest Control; a) Seed treatment b) Insecticide c) Rodenticides d) Fungicides					
8.	Harvesting: a) Improved Manual b) Improved Mechanical					

SECTION D: **Level of Adoption and effects of AROC's introduced Rice Production Technology**

S/N	**OUTPUT**	**To a great extent**	**To a little extent**	**To no extent**
1.	Increased income			
2.	Increased yield			
3.	Availability of planting materials			
4.	Reduced cost of production			
5.	Increase knowledge on rice production			
6.	A greater market command			
7.	Reduced poverty			
8.	Improved quality of life			

SECTION E: **Constraints to adoption of AROC's introduced Rice Production Technology**

S/N	SOCIOECONOMIC DETERMINANT	Highly Significant	Significant	No Significant
1.	Inadequate information/knowledge about the technologies			
2.	Inadequate knowledge on technology's economic benefits			
3.	Weak social network/interpersonal within the community			
4	Poor delivery/conduct of AROC activities			
5.	Lack of visit to AROC centre due to distance or proximity to the centre			
6.	Poor access to extension services			
7.	Technologies are perceive to be of less relative advantage			
8.	Technologies are of high complexity on application			
9.	Inadequate Farm Land			
10.	Inadequate Capital			
11.	Peer effect/discouragement by other farmers			
12	Lack of accessibility of hybrid media (Text messages/Whatsapp)			
13	Others (specify) ……..…… ……..			

APPENDIX 2

Multiple Regression Result

Dependent Variable: LOA
Method: Least Squares
Date: 08/14/08 Time: 11:05
Sample: 1 180
Included observations: 180

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.598931	0.073543	8.143904	0.0000
AGE	-0.003081	0.000794	-3.881772	0.0001
CPM	0.022148	0.016453	1.346150	0.1800
FEXP	-0.006227	0.001995	-3.121843	0.0021
FLS	-0.005678	0.004531	-1.253169	0.2119
FSIZE	0.013815	0.007032	1.964638	0.0511
MS	0.005116	0.033419	0.153096	0.8785
SCH	0.010309	0.001257	8.201990	0.0000
STV	0.016251	0.003202	5.074713	0.0000

R-squared	0.849881	Mean dependent var	0.592333
Adjusted R-squared	0.842858	S.D. dependent var	0.156830
S.E. of regression	0.062169	Akaike info criterion	-2.669206
Sum squared resid	0.660918	Schwarz criterion	-2.509558
Log likelihood	249.2285	Hannan-Quinn criter.	-2.604475
F-statistic	121.0119	Durbin-Watson stat	1.407900
Prob(F-statistic)	0.000000		

AGE
CPM
FEXP
FLS
FSIZE
MS
SCH
STV

APPENDIX 3

Adoption level and socio-economic characteristics of respondents.

LOA	Age	MS	SCH	FSIZE	FEXP	FLS	CPM	STV
84	41	2	12	6	3	2	1	11
76	48	2	7	4	2	3	1	9
50	56	2	0	2	8	5	1	7
44	55	2	0	2	11	3	1	4
40	47	2	0	2	12	5	1	5
52	61	2	0	4	10	11	1	6
80	54	2	12	4	8	8	1	11
84	51	2	13	3	4	5	1	12
76	45	2	6	3	5	3	1	9
48	52	2	0	2	9	7	0	5
80	45	2	6	2	5	18	1	9
44	61	2	0	2	5	12	1	5
36	41	2	0	1	15	2	1	6
64	38	2	15	1	1	5	1	12
48	37	2	0	2	10	4	0	6
40	61	2	0	4	13	12	1	5
44	51	2	0	3	7	14	1	4
76	46	2	7	3	5	8	0	12
80	32	2	15	2	4	2	1	10
84	42	2	13	2	5	5	1	12
76	32	2	6	1	3	11	1	8
36	72	2	0	4	12	7	0	3
48	55	2	0	3	8	7	1	7
68	64	2	6	4	5	6	0	9
84	52	2	15	3	3	5	1	11
48	48	2	0	2	5	6	1	6
76	43	2	6	2	4	5	1	5
64	48	2	6	3	5	8	1	4
80	52	2	16	3	4	7	1	12
48	56	2	0	3	9	8	1	6
44	56	2	0	2	5	15	1	6
52	46	2	0	3	7	5	1	5
80	44	2	12	2	3	11	1	9
38	58	2	0	2	10	12	1	7
76	42	2	12	2	3	2	1	11

68	52	2	7	3	5	8	1	8
76	52	2	14	2	6	14	1	9
36	48	2	0	3	4	6	1	5
72	46	2	6	3	3	8	1	8
52	40	2	0	2	6	2	1	6
80	38	2	14	2	5	5	0	9
76	35	2	13	2	4	2	1	10
76	32	2	12	2	2	2	1	11
40	51	2	0	3	12	12	1	5
36	56	2	0	3	10	5	1	4
48	59	2	0	3	9	8	1	7
80	55	2	20	2	4	7	1	12
64	30	2	8	3	4	7	1	9
48	58	2	0	3	5	12	0	6
44	51	2	0	3	5	8	1	6
72	48	2	16	3	4	8	1	8
80	56	2	16	3	5	11	1	9
44	57	2	0	4	5	7	1	4
48	53	2	0	3	5	6	1	6
40	62	2	0	4	5	15	0	5
68	54	2	8	3	5	12	1	8
72	55	2	14	2	4	8	1	9
68	47	2	7	3	3	11	0	6
76	52	2	13	2	4	16	1	9
68	50	2	8	2	3	11	1	12
48	48	2	0	3	3	9	1	5
36	61	2	0	3	5	6	0	6
80	54	2	18	2	3	4	1	9
40	46	2	0	2	15	5	1	7
84	47	2	16	3	5	4	1	8
48	56	2	0	3	5	8	1	4
44	58	2	0	3	5	7	1	5
68	38	2	14	2	3	5	1	6
48	56	2	0	3	10	13	1	5
88	46	2	17	2	4	2	1	11
72	57	2	8	4	5	12	1	11
72	45	2	6	2	3	5	1	13
44	52	2	0	2	11	8	1	4
36	60	2	0	3	15	12	0	5
72	50	2	16	2	6	10	1	9
76	49	2	15	3	4	8	1	9

68	55	2	8	2	3	5	1	8
32	54	2	0	3	14	7	1	7
72	59	2	16	3	7	8	1	10
40	59	2	0	3	9	6	1	6
32	51	2	0	3	10	11	0	6
48	56	2	0	3	11	8	1	6
72	55	2	20	2	5	5	1	12
44	52	2	0	3	8	4	1	7
76	45	2	13	2	5	8	1	9
48	54	2	0	2	9	2	1	6
64	57	2	15	3	7	12	1	11
48	30	2	0	1	13	14	1	6
28	62	2	0	3	12	11	1	6
44	55	2	0	3	10	6	1	4
52	62	2	0	3	8	12	1	7
48	61	2	0	3	9	5	1	5
72	40	2	14	2	4	15	1	10
44	58	2	0	3	8	11	1	5
84	48	2	18	2	4	8	1	9
48	63	2	0	4	13	12	1	6
44	60	2	0	3	11	11	1	6
80	38	2	13	1	5	5	1	12
76	33	1	13	1	3	2	1	12
48	54	2	0	2	7	5	1	5
72	41	2	12	1	4	2	1	11
52	44	2	0	2	10	5	1	5
44	59	2	0	2	8	4	1	5
48	52	2	0	3	11	8	1	3
44	46	2	0	2	9	9	1	4
44	59	2	0	3	12	12	1	6
76	55	2	14	2	9	5	1	8
52	51	2	0	3	14	4	1	6
56	48	2	0	2	9	5	1	7
32	46	2	0	2	15	4	1	4
48	51	2	0	3	10	5	1	5
72	53	2	16	3	7	3	1	9
52	56	2	0	2	8	2	1	6
72	61	2	7	3	9	8	1	7
52	58	2	0	3	10	7	1	6
48	54	2	0	2	12	5	1	5
76	46	2	16	2	7	2	1	7

52	45	2	0	2	9	5	1	2
80	47	2	16	2	6	2	1	9
76	44	2	14	2	4	5	1	9
56	28	1	0	1	2	12	1	4
44	25	2	0	1	9	3	0	3
48	58	2	0	3	10	11	1	3
80	46	2	14	2	5	5	1	8
76	64	2	8	3	10	17	1	7
60	60	2	0	3	9	11	1	6
56	58	2	0	2	11	12	1	4
84	48	2	16	3	2	5	1	8
52	51	2	0	2	9	7	0	5
48	58	2	0	2	10	8	1	6
40	55	2	0	3	12	6	1	6
68	32	2	14	2	3	3	1	8
48	59	2	0	3	12	10	1	6
72	55	2	13	2	8	7	1	6
44	58	2	0	3	10	6	0	5
52	62	2	0	3	9	13	1	4
72	43	1	14	2	4	5	1	9
72	30	2	12	1	3	3	0	6
40	51	2	0	2	8	4	1	6
48	46	2	0	2	11	3	1	3
44	58	2	0	3	9	8	1	3
72	43	2	12	2	4	2	1	7
80	46	2	14	2	5	2	1	8
56	58	2	0	3	5	7	1	5
72	46	2	16	2	6	4	1	7
32	60	2	0	3	14	21	1	8
40	56	2	0	3	11	3	1	6
72	47	2	13	2	5	4	1	8
56	58	2	0	2	8	22	1	6
44	54	2	0	2	9	14	1	5
48	59	2	0	3	11	21	1	5
76	52	2	11	3	10	9	1	8
60	60	2	0	3	12	24	1	4
56	56	2	0	3	9	12	1	4
48	60	2	0	3	5	14	1	6
80	57	2	14	2	6	12	1	8
76	61	2	6	3	5	11	1	7
44	55	2	0	2	9	17	1	6

72	41	2	12	2	5	9	1	8
48	63	2	0	3	11	12	1	5
60	35	2	10	2	4	4	1	9
72	50	2	20	2	9	14	1	9
84	27	2	11	2	3	3	1	9
48	64	2	0	3	12	24	1	3
44	55	2	0	2	10	11	1	5
64	48	2	7	2	5	6	1	6
68	52	2	8	2	4	11	1	6
52	43	2	0	2	6	8	1	5
48	54	2	0	3	9	11	1	4
36	58	2	0	3	15	13	1	4
40	56	2	0	3	12	12	1	6
80	58	2	16	2	5	16	1	5
72	48	2	13	2	3	7	1	8
68	31	2	12	2	5	3	1	6
48	61	2	0	3	12	15	1	4
76	26	1	13	1	3	3	0	6
64	65	2	0	3	9	19	1	8
76	40	2	8	2	5	7	1	7
48	62	2	0	2	10	17	1	4
80	58	2	11	3	6	12	1	9

APPENDIX 4

Socio-Economic Characteristics of Respondents

Quest no	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q10	Q11	Q12	Q13	Q14
	Farmer name	FarmComm	Village	LGA	Gend	Age	Marital status	Yrs Schl	Farm size	Farm Exp	Family Size	Farm Acq	Ann Rice Inc
1	Moh`d Nmabu	Ndagbachi	Ndagbachi	Gbako	1	41	2	12	3	3	2	1	400,000
2	Umaru Usman	Ndagbachi	Ndagbachi	Gbako	1	48	2	7	3	2	3	1	350,000
3	Daudu Umaru	Ndagbachi	Ndagbachi	Gbako	1	65	2	0	2	8	2	2	250,000
4	DaudA Umaru	Emiworo	Ndagbachi	Gbako	1	65	2	0	2	11	3	1	220,000
5	Abubakar Isah	Ndagbachi	Ndagbachi	Gbako	1	57	2	0	2	12	1	1	150,000
6	Yahaya Aliyu	Emiworo	Ndagbachi	Gbako	1	68	2	0	4	10	8	1	245,000
7	Yahaya Umaru	Ndagbachi	Ndagbachi	Gbako	1	54	2	12	4	8	3	1	300,000
8	Usman Umaru	Ndagbachi	Ndagbachi	Gbako	1	51	2	13	3	4	2	4	200,000
9	Abdullahi Katun	Ndagbachi	Ndagbachi	Gbako	1	45	2	6	3	5	2	1	200,000
10	Usman Kafinta	Ndagbachi	Ndagbachi	Gbako	1	56	2	0	2	9	3	1	200,000
11	Ndako Daudu	Ndagbachi	Ndagbachi	Gbako	1	45	2	6	2	5	5	1	190,000
12	Baba A. Adamu			Gbako	1	61	2	0	2	5	7	4	185,000
13	Alhassan Mau	Ndagbachi	Ndagbachi	Gbako	1	66	2	0	1	15	4	1	90,000
14	Ndagi Mau	Ndagbachi	Ndagbachi	Gbako	1	38	2	15	1	1	2	4	100,000
15	Baba A. Yisan Abubakar	Ndagbachi	Ndagbachi	Gbako	1	51	2	0	2	10	5	4	170,000
16	Moh`d Mohammed	Ndagbachi	Ndagbachi	Gbako	1	61	2	0	4	13	6	1,4	300,000
17	Saba	Ndagbachi	Ndagbachi	Gbako	1	51	2	0	3	7	4	1,4	200,000
18	Moh Moh	Ndagbachi	Ndagbachi	Gbako	1	46	2	7	3	5	3	2	300,000
19	Baba Alhassan	Ndagbachi	Ndagbachi	Gbako	1	32	2	15	2	4	2	1	200,000
20	Idirsu Salihu	Ndagbachi	Ndagbachi	Gbako	1	46	2	23	2	5	3	1	200,000
21	Umaru Moh`d Abdullahi	Ndagbachi	Ndagbachi	Gbako	1	32	2	6	1	3	2	2	100,000
22	Yunusa	Eminoro	Ndagbachi	Gbako	1	72	2	0	4	12	10	1,4	300,000
23	Alhassan Tsadu Abubakar	Ndagbachi	Ndagbachi	Gbako	1	64	2	0	3	8	8	4	240,000
24	Yunusa	Emiworo	Ndagbachi	Gbako	1	55	2	6	4	5	3	1	400,000
25	Kotsu Daudu	Emiworo	Ndagbachi	Gbako	1	52	2	15	3	3	6	4	300,000
26	Shaibu Moh	Emiworo	Ndagbachi	Gbako	1	57	2	0	2	5	9	1	130,000
27	Yahaya Usman	Emiworo	Ndagbachi	Gbako	1	46	2	6	2	4	2	1	170,000
28	Aliyu Umaru	Emiworo	Ndagbachi	Gbako	1	48	2	6	3	5	2	1	300,000
29	Zakari Aliyu	Ndagbachi	Ndagbachi	Gbako	1	52	2	16	3	4	3	4	270,000
30	Yunusa Aliyu	Emiworo	Ndagbachi	Gbako	1	66	2	0	3	9	3	4	200,000

31	Moh`d Haruna	Dabarako	Dabarako	Gbako	1	67	2	0	2	5	4	3	225,000
32	Baba Alhassan	Dabarako	Dabarako	Gbako	1	55	2	0	3	7	5	4	210,000
33	Abubakar Bakeke	Dabarako	Dabarako	Gbako	1	46	2	12	2	3	5	1	190,000
34	Moh`d Danteni	Dabarako	Dabarako	Gbako	1	68	2	0	2	10	4	4	165,000
35	Abba Hassan	Dabarako	Dabarako	Gbako	1	42	2	12	2	3	1	1	200,000
36	Hassan Moh`d	Dabarako	Dabarako	Gbako	1	52	2	7	3	5	3	1	200,000
37	Mohammed Taro	Dabarako	Dabarako	Gbako	1	49	2	14	2	6	3	1	180,000
38	Abubakar Moh	Dabarako	Dabarako	Gbako	1	58	2	0	3	4	3	4	280,000
39	Mamudu	Dabarako	Dabarako	Gbako	1	46	2	6	3	3	3	1	200,000
40	Alhassan tentungi	Dabarako	Dabarako	Gbako	1	47	2	0	2	6	5	1	180,000
41	Manu Yahaya	Dabarako	Dabarako	Gbako	1	38	2	14	2	5	3	1	200,000
42	Baba Nwa	Dabarako	Dabarako	Gbako	1	35	2	13	2	4	2	1	300,000
43	Baba Moh	Dabarako	Dabarako	Gbako	1	32	2	12	2	2	2	1	200,000
44	Moh Moh	Dabarako	Dabarako	Gbako	1	51	2	0	3	12	4	1	390,000
45	Baba Doko Moh	Dabarako	Dabarako	Gbako	1	66	2	0	3	10	5	1	312,000
46	Mallam Baba	Dabarako	Dabarako	Gbako	1	69	2	0	3	9	4	1	265,000
47	Musa Moh	Dabarako	Dabarako	Gbako	1	55	2	20	2	4	3	1	200,000
48	Alhaji Moh`d	Dabarako	Dabarako	Gbako	1	46	2	8	3	4	3	1	290,000
49	Labour	Dabarako	Dabarako	Gbako	1	58	2	0	3	5	4	1	200,000
50	Maikudi Moh`d	Dabarako	Dabarako	Gbako	1	51	2	0	3	5	3	1	280,000
51	Zakari Moh`d	Dabarako	Dabarako	Gbako	1	48	2	16	3	4	3	4	300,000
52	Usman Moh`d	Dabarako	Dabarako	Gbako	1	52	2	16	3	5	3	4	200,000
53	Salihu Baba	Dabarako	Dabarako	Gbako	1	57	2	0	4	5	3	1	360,000
54	Isah Harunah	Dabarako	Dabarako	Gbako	1	66	2	0	3	5	3	4	200,000
55	Alhaji Moh`d	Dabarako	Dabarako	Gbako	1	62	2	0	4	5	5	1	300,000
56	Moh`d Usman	Dabarako	Dabarako	Gbako	1	54	2	8	3	5	4	1	290,000
57	Ladada Moh`d	Dabarako	Dabarako	Gbako	1	55	2	14	2	4	3	4	200,000
58	Abubakar Baba	Dabarako	Dabarako	Gbako	1	47	2	7	3	3	3	4	300,000
59	Baba Haruna	Dabarako	Dabarako	Gbako	1	51	2	13	2	4	3	1	200,000
60	Ibrahim Dya Dya	Emitsunda dan	Emitsunda dan	Lavun	1	50	2	8	2	3	4	1	290,000
61	Hussaini Ndagi	Emitsunda dan	Emitsunda dan	Lavun	1	58	2	0	3	3	6	1	200,000
62	Moh`d Abdullahi	Emitsunda dan	Emitsunda dan	Lavun	1	66	2	0	3	5	5	4	220,000
63	Umaru Sanda	Emitsunda dan	Emitsunda dan	Lavun	1	54	2	18	2	3	2	1	190,000
64	Yunusa Musa	Emitsunda dan	Emitsunda dan	Lavun	1	67	2	0	2	15	7	1	180,000
65	Moh`d Moh.d	Emitsunda dan	Emitsunda dan	Lavun	1	47	2	16	3	5	3	1	300,000
66	Makun Duniya	Emitsunda	Emitsunda	Lavun	1	56	2	0	3	5	3	1	250,000

		dan	dan										
67	Ibrahim Idrisu	Emitsunda dan	Emitsunda dan	Lavun	1	68	2	0	3	5	3	1	270,000
68	Alhaji Musa	Emitsunda dan	Emitsunda dan	Lavun	1	38	2	14	2	3	2	1	300,000
69	Musa Yusuf	Emitsunda dan	Emitsunda dan	Lavun	1	66	2	0	3	10	5	1	150,000
70	Hassan Shehu	Emitsunda dan	Emitsunda dan	Lavun	1	46	2	17	2	4	3	1	290,000
71	Usman Yabagi	Emitsunda dan	Emitsunda dan	Lavun	1	55	2	8	4	5	4	1	300,000
72	Moh`d Baba	Emitsunda dan	Emitsunda dan	Lavun	1	46	2	6	2	3	2	1	300,000
73	Alhassan Idrisu	Emitsunda dan	Emitsunda dan	Lavun	1	62	2	0	2	11	4	1	200,000
74	Usman Moh`d	Emitsunda dan	Emitsunda dan	Lavun	1	60	2	0	3	15	5	1	190,000
75	Hassan Hussaini	Emitsunda dan	Emitsunda dan	Lavun	1	50	2	16	2	6	4	4	200,000
76	Ahmadu Aliyu	Emitsunda dan	Emitsunda dan	Lavun	1	49	2	15	3	4	3	1	300,000
77	Alhaji Moh`d	Emitsunda dan	Emitsunda dan	Lavun	1	55	2	8	2	3	2	4	100,000
78	Adamu Ibrahim	Emitsunda dan	Emitsunda dan	Lavun	1	66	2	0	3	14	6	1	140,000
79	Jibrin Yaya	Emitsunda dan	Emitsunda dan	Lavun	1	54	2	16	3	7	3	4	300,000
80	Hassan Hussaini	Emitsunda dan	Emitsunda dan	Lavun	1	68	2	0	3	9	4	1	150,000
81	Alhaji Abdullahi	Emitsunda dan	Emitsunda dan	Lavun	1	51	2	0	3	10	5	1	140,000
82	Yahaya Moh`d	Emitsunda dan	Emitsunda dan	Lavun	1	56	2	0	3	11	5	1	215,000
83	Musa Aliyu	Emitsunda dan	Emitsunda dan	Lavun	1	55	2	20	2	5	4	4	100,000
84	Aliyu Aliyu	Emitsunda dan	Emitsunda dan	Lavun	1	62	2	0	3	8	4	4	240,000
85	Ibrahim Aliyu	Emitsunda dan	Emitsunda dan	Lavun	1	46	2	13	2	5	2	1	300,000
86	Hussaini Aliyu	Emitsunda dan	Emitsunda dan	Lavun	1	54	2	0	2	9	5	1	205,000
87	Yaya Aliyu	Emitsunda dan	Emitsunda dan	Lavun	1	55	2	15	3	7	4	1	300,000
88	Usman Musa	Emitsunda dan	Emitsunda dan	Lavun	1	48	2	0	1	13	3	1	150,000
89	Abdullahi Dogo	Emitsunda dan	Emitsunda dan	Lavun	1	66	2	0	3	12	6	1	180,000
90	Moh`d Musa	Emitsunda dan	Emitsunda dan	Lavun	1	56	2	0	3	10	5	1	200,000
91	Aliyu Hussaini	Emitsunda dan	Emitsunda dan	Lavun	1	52	2	0	3	8	4	1	210,000
92	Jibrin Moh`d	Lemuta	Emitsunda	Lavun	1	54	2	0	3	9	4	1	250,000

			dan										
93	Ibrahim Moh`d	Lemuta	Emitsunda dan	Lavun	1	54	2	14	2	4	2	1	250,000
94	Gimba Moh`d	Lemuta	Emitsunda dan	Lavun	1	58	2	0	3	8	5	1	210,000
95	Salihu Moh`d	Lemuta	Emitsunda dan	Lavun	1	48	2	18	2	4	3	1	300,000
96	Yabala Moh`d	Lemuta	Emitsunda dan	Lavun	1	66	2	0	4	13	5	1	400,000
97	Kudu Moh`d	Lemuta	Emitsunda dan	Lavun	1	60	2	0	3	11	4	1	270,000
98	Yamayaya Abdullahi	Lemuta	Emitsunda dan	Lavun	1	48	2	13	1	5	2	1	75,000
99	Abdullahi titigi	Lemuta	Emitsunda dan	Lavun	1	50	1	13	1	3	1	1	80,000
100	Baba Moh`d	Lemuta	Emitsunda dan	Lavun	1	55	2	0	2	7	4	1	210,000
101	Ibrahim Moh`d	Lemuta	Emitsunda dan	Lavun	1	41	2	12	1	4	3	1	95,000
102	Umaru Moh`d	Lemuta	Emitsunda dan	Lavun	1	67	2	0	2	10	5	1	280,000
103	Jiya Moh`d	Lemuta	Emitsunda dan	Lavun	1	58	2	0	2	8	3	1	180,000
104	Ndagi Gbachitako	Lemuta	Emitsunda dan	Lavun	1	52	2	0	3	11	4	1	270,000
105	Alhaji wamako	Lemuta	Emitsunda dan	Lavun	1	66	2	0	2	9	5	1	160,000
106	Baba Abdullahi	Lemuta	Emitsunda dan	Lavun	1	59	2	0	3	12	4	1	250,000
107	Hussaini Abdullahi	Lemuta	Emitsunda dan	Lavun	1	55	2	14	2	9	3	1	190,000
108	Usman Yaya	Lemuta	Emitsunda dan	Lavun	1	51	2	0	3	14	4	1	300,000
109	Moh`d Emigbari	Lemuta	Emitsunda dan	Lavun	1	56	2	0	2	9	3	1	285,000
110	Alhassan Moh`d	Lemuta	Emitsunda dan	Lavun	1	68	2	0	2	15	4	1	180,000
111	Abdullahi Ekota	Lemuta	Emitsunda dan	Lavun	1	51	2	0	3	10	6	1	290,000
112	Moh`d Jiya	Lemuta	Emitsunda dan	Lavun	1	53	2	16	3	7	4	1	290,000
113	Alhaji Moh`d	Lemuta	Emitsunda dan	Lavun	1	56	2	0	2	8	4	1	100,000
114	Abdullahi Dogo	Lemuta	Emitsunda dan	Lavun	1	47	2	7	3	9	4	1	300,000
115	Abubakar Moh`d	Lemuta	Emitsunda dan	Lavun	1	58	2	0	3	10	5	1	270,000
116	Kawu Ibrahim	Lemuta	Emitsunda dan	Lavun	1	54	2	0	2	12	4	3	240,000
117	Ibrahim Moh`d	Lemuta	Emitsunda dan	Lavun	1	46	2	16	2	7	3	3	200,000
118	Baba Moh`d	Lemuta	Emitsunda	Lavun	1	55	2	0	2	9	4	1	200,000

			dan										
119	Moh`d B, Moh. Alhassan	Lemuta	Emitsunda dan	Lavun	1	47	2	16	2	6	3	1	250,000
120	Dagachi	Dwarfu	Dwarfu	Katcha	1	54	2	14	2	4	2	1	170,000
121	Yabagi Gaga	Dwarfu	Dwarfu	Katcha	1	46	1	0	1	2	1	1	100,000
122	Umaru Gabi I	Dwarfu	Dwarfu	Katcha	1	66	2	0	1	9	4	1	100,000
123	Umaru Gabi II	Dwarfu	Dwarfu	Katcha	1	61	2	0	3	10	5	1	200,000
124	Nda Aliyu	Dwarfu	Dwarfu	Katcha	1	46	2	14	2	5	3	4	280,000
125	Saidu Aliyu	Dwarfu	Dwarfu	Katcha	1	54	2	8	3	10	6	1	250,000
126	Nda Umaru	Dwarfu	Dwarfu	Katcha	1	60	2	0	3	9	5	1	190,000
127	Hussaini Ibrahim	Dwarfu	Dwarfu	Katcha	1	58	2	0	2	11	4	4	220,000
128	Isah Abubakar	Dwarfu	Dwarfu	Katcha	1	48	2	16	3	2	4	1	286,000
129	Yabagi Umaru	Dwarfu	Dwarfu	Katcha	1	51	2	0	2	9	3	3	164,000
130	Danlami Umaru	Dwarfu	Dwarfu	Katcha	1	58	2	0	2	10	4	4	200,000
131	Danladi Umaru	Dwarfu	Dwarfu	Katcha	1	66	2	0	3	12	6	4	210,000
132	Ndagi Ibrahim	Dwarfu	Dwarfu	Katcha	1	32	2	14	2	3	2	1	200,000
133	Baba Abubakar	Aye	Dwarfu	Katcha	1	59	2	0	3	12	5	4	286,000
134	Nma Nba Isah	Aye	Dwarfu	Katcha	1	55	2	13	2	8	4	4	200,000
135	Isah N Yusuf	Aye	Dwarfu	Katcha	1	58	2	0	3	10	5	1	286,000
136	Gimba S. Baba	Aye	Dwarfu	Katcha	1	67	2	0	3	9	6	1	272,000
137	Audu Malik	Aye	Dwarfu	Katcha	1	53	1	14	2	4	2	1	286,000
138	Saba Liman	Aye	Dwarfu	Katcha	1	30	2	12	1	3	1	1	230,000
139	Baba Abubakar	Aye	Dwarfu	Katcha	1	51	2	0	2	8	4	3	200,000
140	Suleman Moh	Aye	Dwarfu	Katcha	1	56	2	0	2	11	4	1	200,000
141	Moh`d Zanguru	Aye	Dwarfu	Katcha	1	68	2	0	3	9	6	1	300,000
142	Adamu Dachi	Aye	Dwarfu	Katcha	1	43	2	12	2	4	3	1	200,000
143	Baba Baba Moh	Aye	Dwarfu	Katcha	1	46	2	14	2	5	2	1	100,000
144	Alhassan Adamu	Dwarfu	Dwarfu	Katcha	1	58	2	0	3	5	5	1	252,000
145	Alhassan Idrisu	Dwarfu	Dwarfu	Katcha	1	46	2	16	2	6	3	1	100,000
146	Yusuf Usman	Dwarfu	Dwarfu	Katcha	1	60	2	0	3	14	6	1	272,000
147	Yahaya Teaton	Dwarfu	Dwarfu	Katcha	1	56	2	0	3	11	5	1	210,000
148	Ndaazumi Tsofada	Dwarfu	Dwarfu	Katcha	1	47	2	13	2	5	3	1	100,000
149	Nda Nasara	Dwarfu	Dwarfu	Katcha	1	58	2	0	2	8	3	3	200,000
150	Abdul Umar	Dwarfu	Dwarfu	Katcha	1	54	2	0	2	9	4	1	200,000
151	Nmabagi Abdullahi	Dwarfu	Dwarfu	Katcha	1	69	2	0	3	11	5	1	285,000
152	Abdullahi Doko	Dwarfu	Dwarfu	Katcha	1	52	2	11	3	10	3	1	200,000
153	Abdullah tako	Dwarfu	Dwarfu	Katcha	1	66	2	0	3	12	5	1	200,000
154	Abdullahi Idrisu	Dwarfu	Dwarfu	Katcha	1	56	2	0	3	9	4	1	200,000

155	Ndako Abdullahi	Dwarfu	Dwarfu	Katcha	1	60	2	0	3	5	4	1	238,000
156	Salihu Zaiburu	Dwarfu	Dwarfu	Katcha	1	55	2	14	2	6	3	4	190,000
157	Shehu Tswayan	Dwarfu	Dwarfu	Katcha	1	51	2	6	3	5	4	4	250,000
158	Idrisu Isah	Dwarfu	Dwarfu	Katcha	1	58	2	0	2	9	3	4	200,000
159	Abdullahi Y. Saidu	Dwarfu	Dwarfu	Katcha	1	41	2	12	2	5	3	1	180,000
160	Mallam Saidu	Dwarfu	Dwarfu	Katcha	1	63	2	0	3	11	4	1	272,000
161	Nma Sani Salihu	Aye	Dwarfu	Katcha	1	48	2	10	2	4	1	1	195,000
162	Ndalu Adamu	Aye	Dwarfu	Katcha	1	52	2	20	2	9	3	1	200,000
163	Audu Abdullahi	Aye	Dwarfu	Katcha	1	35	2	11	2	3	1	1	200,000
164	Alhaji Ibrahim	Aye	Dwarfu	Katcha	1	55	2	0	3	12	5	1	285,000
165	Ndatsu Ibrahim	Aye	Dwarfu	Katcha	1	64	2	0	2	10	4	1	238,000
166	Usman Abdullahi	Aye	Dwarfu	Katcha	1	48	2	7	2	5	3	4	275,000
167	Mamudu Yakubu	Aye	Dwarfu	Katcha	1	52	2	8	2	4	2	1	100,000
168	Gangwa S Baba	Aye	Dwarfu	Katcha	1	63	2	0	2	6	3	1	200,000
169	Aliyu Umaru	Aye	Dwarfu	Katcha	1	66	2	0	3	9	4	1	195,000
170	Moh`d Dyadya	Aye	Dwarfu	Katcha	1	58	2	0	3	15	6	4	200,000
171	Abdullahi Umar	Aye	Dwarfu	Katcha	1	56	2	0	3	12	5	1	200,000
172	Baba Doko Moh	Aye	Dwarfu	Katcha	1	48	2	25	2	5	2	4	285,000
173	Danjuma Moh	Aye	Dwarfu	Katcha	1	51	2	13	2	3	1	4	250,000
174	Danjuma Moh 1	Aye	Dwarfu	Katcha	1	36	2	15	2	5	3	1	190,000
175	Baba A Abubakar	Aye	Dwarfu	Katcha	1	61	2	0	3	12	4	1	200,000
176	Umaru Dwale 1	Aye	Dwarfu	Katcha	1	29	1	13	1	3	1	4	80,000
177	Umar Dwale 2	Aye	Dwarfu	Katcha	1	65	2	0	3	9	4	1	275,000
178	Samba A Liman	Aye	Dwarfu	Katcha	1	40	2	8	2	5	3	4	200,000
179	Jiya Yahaya	Aye	Dwarfu	Katcha	1	62	2	0	2	10	4	4	200,000
180	Moh Dyadya	Aye	Dwarfu	Katcha	1	52	2	11	3	6	3	4	292,000