CHAPTER ONE

1.0. INTRODUCTION

1.1. Background of the Study

In Nigeria today, rice have been one of the essential food which is in every household table. Rice is the seed of the grass species *oryza sativa or oryza glaberrima*. As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia (Wikipeda). It is the agricultural commodity with the third highest worldwide production after sugarcane and maize (FAOSTAT, 2012). Rice is the most important grain with regard to human nutrition and caloric intake, providing more than one-fifth of the calories consumed worldwide by humans. Rice can come in many shapes, colours and sizes (IRRI, 2009). Rice a monocot, is normally grown as an annual plant although in tropical areas it can survive as a perennial and can produce a ratoon crop for up to 30 years. According to, FADAMA III AP (206) rice will be cultivated thrice in a year by the use of irrigation. The rice plant can grow to 1-1.8m tall occasionally more depending on the variety and soil fertility. Rice can grow in different environments depending upon water availability. Generally, rice does not thrive in a water logged area, yet it can survive and grow therein and it can also survive flooding. The benefit of this type of farming to the production of rice in Nigeria is enormous. It will enhance self-sufficiency making rice to be available throughout the year (Mohammed, 2002). Research has shown that crops grown during this period are less prone to pest and disease problem (Okunlola, 2000). The cultural practices are also very much reduced as weed grow less than those crops planted during the rainy season, thus the yields of these crops are robust, healthy and attractive to consumers (Ogundele, 2001).

The word "FADAMA" (in Hausa local language) means a low lying area which the National FADAMA Development programme (NFDP) initiated following the recommendations of the World Bank in its report of 1989 titled "**Nigeria- Strategy for Agricultural Growth**". It identified the development of small-scale irrigation for the production of off-session high value crops in order to increase the

productivity, income, living standard and development capacity of the rural poor in Nigeria. To that effect, the World Bank funded the National FADAMA Development Project I (NFDP-1) which lasted between 1993-1999, and was implemented in Bauchi, Gombe, Kano, Jigawa, Sokoto, Zamfara, Ebonyi, and Kebbi States etc.

FADAMA farming therefore implies cultivation of growing of crop under irrigation or in the river flood plain. This implies that, is a farming system that operates in the dry sessions. This is because flood plains are inaccessible during the normal farming season.

Apart from the economic shift to agriculture, it is to be noted that agricultural production in Nigeria is dictated by climatic and Delphic conditions. These factors determine the range of crop planted, and the efficiency of the crop production is rain fed, thus determining the agricultural production session. However, there are agricultural production systems that could be explored to support an all year round food production (especially rice), and one of such is FADAMA system of farming.

It is recommended to apply modern science and technology to traditional act of farming as a way of incorporating farmers into the development stream. Scholars also suggest using the indigenous knowledge of farmers in the process of generating and disseminating technologies / innovations and integrating them into the overall knowledge system. To Adebayo, Omotayo, Garforth and Awotunde (2002), the farmer has been the life wire of Nigerian agriculture by combining their limited stock of the necessary factors of production (such as the land, capital, labour and time) hence serving as the principal wheel of agricultural expansion.

Technology means all those methods of production which have been developed or could be developed with the existing State of scientific knowledge (Mgbada, 2002). Technology helps us to do those things we need or want to do better. However, using technology that is inappropriate is at best wasteful and at worst harmful to people and the environment. It is appropriate for the task, the environment and the people. For instance, there are three levels of technology. The Nigerian farmer is using a sample hoe (low technology). The plough drawn by animals is more productive but still straight forward (intermediate technology). The

tractor is highly complex (high technology) but allows one person to cultivate a larger area. Technology is basically a tool to help create development towards certain agreed overall goals. The choice of technology is important in deciding what type of development, and for whom. It is important to people, human needs, in the center of the development of any technology.

Agricultural technology can be defined as any behavior or practice that involves the interaction of individuals within the agricultural production system. From the time farmers decide what to invest in farming until they sell their product, they perform a series of actions that are the product of what they know and what they think is best. Agricultural professionals are also equipped with knowledge that in turn leads them to believe in the effectiveness of particular farm practices or technology. Consequently, those practices and/or behavior applied by both farmers and agricultural professionals constitute agricultural technologies (Asiabaka, 2002). Agricultural technologies include both components (seeds, fertilizers, pesticides and machinery) and the process, that is, elements needed by the producer. The later include information on the component and the management and the technical know-how to use the components and its adoption.

Farmers are the ultimate users of the modern or improved agricultural technologies developed through research. Many workers have defined technology transfer in different ways to suit their purpose.

According to Eze (2005), the basic tenet of the different innovation theories on which extension work is built is that dissemination of information is the basic sociology process potential leading to increased agricultural productivity through adoption of new and/or improved farm practices.

Adoption is a decision made by an individuals or group to use an innovation in a continuous manner. Adoption is regarded by Rogers (1995) as a decision to make full use of an innovation or technology as the best course of action available. According to Van den Ban and Hawkins (1996), adoption of innovation is the decision of individual or group to use or apply an innovation.

In Nigeria, a number of institutional and government organs have been established to ensure that farmers get to know and adopt agricultural innovations

relevant to their situations. These bodies disseminate or facilitate dissemination of agricultural innovation through different methods.

The transfer of information could be done by the use of information media. Such information media include newsletter, radio/television, programme, extension publications/bulletins, field days, field trips, giggles, posters, leaflets, agricultural how and exhibition. The research is developing appropriate and adoptable technologies and transforming such technology to the farmers. According to Unamma *et al* (2004), the job of research is to develop technologies and improve their worth to a relatively small number of farmers, using various combinations of upstream and downstream research. The extension service and/or any other similar organization complement this role of research through diffusion of the innovation to as many farmers as practicable, using appropriate strategies. Consequently, the extension service is responsible for informing, advising and teaching large number of farmers and other input agencies in a timely fashion.

The role of Agricultural Extension has been orchestrated and recognized as crucial to the overall development of agriculture in the country. According to Masha (2000), agricultural extension has three main functions which are to:

1. Change farmers attitude towards the acceptance of farm innovations, thereby making them realize the need to adopt improved technology for higher production.
2. Disseminate to the farmers the results of research and take back farmer's problems to the research institutions.
3. help farmers gain managerial skills to operate in a commercial economy.

Onu and Anyanwu (2000) also expressed that, among others, the traditional responsibility of the agricultural extension worker include

the following:

a. Keeping farmers informed of the latest development and recommendations relating to better techniques of production.
b. Bringing back to the research center farmers views about their production and marketing and other felt needs.

c. On the spot teaching and advising of farmers about their production and marketing and other felt needs.

Since the inception of Enugu Agricultural Development Programme (ADP), one of its major responsibilities is the dissemination of information on improved modern technologies to the rural farmers in the three agricultural zones namely, Enugu East, Enugu West and Enugu North.

According to Umebali (2004), cooperative organization can be defined as a group of persons who have pooled themselves and their resources on self-help, mutual equitable and democratic basis to form a business enterprise, which seeks to solve the socio-economic problem(s) of its members. This is by directly providing them with good and services in their double capacity as either owners/customers or owner/workers of the cooperative enterprise. It is better to deal with farmers in group (cooperative) than individual basis, hence the need for farmers in rural areas to join or form cooperatives

1.2 Statement of the Problem

A large percentage of small-scale farmers and farmers cooperatives have not progressed beyond the hoe and cutlass, low inputs agriculture (Isife and Madukwe, 2005; Nnadi and Akwikwu, 2005). According to Fikru (2009), most farmers are poor and operate at subsistence level and investment for intensification of agriculture is not well developed in the country. This has created a vicious circle of low productivity in agricultural production. Land degradation reduces the production of potential of the land and this in turn makes it difficult for farmers to produce enough and invest in protecting the land.

Agricultural production in developing countries faces many hindrances and challenges such as poor agricultural practice, inefficiencies in information delivery records, maintenances between farmers and traders, and lack of information on the use of best agricultural practices among farmers (Abdul, 2013). The major media system that have a lot to contribute to information dissemination in Nigeria are radio, television and print media, radio being the fastest among them (Egbule and Njoku, 2008). The media system in many States in Nigeria are highly centralized and clustered in urban areas. Consequently, very little of the needed information

reaches rural communities, where more of the population live and actual farming take place. They went further to identify the problems of wide spread illiteracy. Majority of the farmers cannot read and write and understand the information at their disposal. Most often the few agricultural programmes are not timed to suit farmers. Consequently most farmers are constrained to rely on third parties for agricultural information which may be biased.

According to Adejare and Arimi (2013) these problem resulted into food insecurity which lead to various researchers into the development of technologies which are aimed at increasing food production to meet the needs of the people and even improve their living standard. According to Kassal (2000) and Oyemade (2003), technology is used to improve human condition, the natural environment or to carry out their socio-economic activities. Agricultural technology includes tools, equipment, agro-chemical, management skills and other process that farmers need to increase production of food. Cooperatives provides better platform for farmers to adopt new agricultural innovations. Since they are in group, extension agents can easily reach them than individually.

To adoption and successfully use improved technologies, rural farmers and farmer's cooperatives must understand them, and this required effective teaching by agricultural extension services. In spite of the abundance of farmland and agricultural technologies evolved from research, the productivity of farmers in the agricultural zones in South-Eastern States is still on the decline (Ohajianya and Onu 2005). This decline is due to the nature of its production and problems underlying its improvement (Adejare and Arinri, 2013).

According to Onu (2005), the unavailability or inadequacy of extension message has often been blamed on the poor performance of extension services. The Agricultural Development Program (ADP) since its inception, had been disseminating useful agricultural information to farmers, yet farmers still practice at subsistence levels. In most cases farmers depend on the local knowledge system for production despite the breakthrough by research. Ditto (2007) asserted that there are

unclear signals to whether the FADAMA and rain-fed rice farmers are making efficient use and management of available farm resources.

Since the new millennium, attention of government has shifted to food security with emphasis on commercial farming driven by innovations and modern technologies. Farmers were asked to form cooperatives in order to access different intervention packages and aids rolled out by the government, development partners and donor agencies. FADAMA programme existed to improve farm output through mitigating the constraints facing improved productivity and increased output.

Many extension agents have been released to field and a number of new technologies have been introduced to farmers. Appreciable level of awareness has been created both at community and macro level by cooperatives, FADAMA office and other government agencies. Rice farming has become critical aspect of Nigerian agricultural revolution. Efforts are made at both federal and State government levels to increase rice production as a means of reducing the country's over dependence on foreign rice importation. Apart from provision of funding and technical assistance to farmers, FADAMA facilitates transfer of technologies. A number of farmers formed and joined agricultural cooperatives in a bid to benefit from these intervention programmes and also due to perceived profitability of rice farming.

In recent times, attention has shifted from creating awareness about these agricultural technologies to adoption of these technologies. With regards to spacing, varieties, line planting, fertilizer application and limitation, many cooperative rice farmers are not only aware but have also tried using these technologies. However, the extent to which these technologies are adopted is largely undetermined.

Although many studies have been conducted on agricultural technologies adoption, majority of those studies were not on rice farming. To the best of the researcher's knowledge, there is limited evidence that a study on extent of adoption of agricultural technology among rice farmers has been conducted in Enugu State.

In order to encourage uptake of these technologies and achieve food security objective of the country, there is the need to understand the extent of adoption of

these agricultural technologies, factors that influence their adoption, as well as roles cooperatives play in the process. This understanding will enable policy makers and analysts to streamline their effort and develop measures to encourage adoption that are effective, efficient and reliable. This study is, therefore, designed not only to determine the extent of adoption of improved agricultural technologies among cooperative rice farmers and factors that influence them but also to examine the significance of agricultural cooperative in the adoption drive.

1.3 Objectives of the study

The broad objective of this study is to analyze the determinants of adoption of improved agricultural technologies among FADAMA rice farmers cooperatives in Enugu State. The specific objectives include to:

1. determine adoption level of selected improved agricultural technologies among rice farmers in Enugu State.
2. examine the factors that influence adoption of improved agricultural technologies among Enugu State rice farmers.
3. ascertain the effect of Socio-economic characteristics of FADAMA rice farmer's cooperative members on adoption level of improved agricultural technologies among FADAMA rice farmers in Enugu State
4. identify constraints to adoption of improved technologies by FADAMA rice farmers in Enugu State

1.4 Research Questions

1. What is the adoption level of various improved agricultural technologies among FADAMA rice farmers in Enugu State?
2. Which factors influence adoption of improved agricultural technologies among cooperative rice farmers?
3. Does socio-economic characteristics of FADAMA rice farmer's cooperative members affect level of adoption of improved agricultural technologies among FADAMA rice farmers in Enugu State?

4. What factors mitigate the adoption of improved agricultural innovations among rice farmers in Enugu State?

1.5 Research Hypothesis

Ho_1: FADAMA cooperative rice farmers in Enugu State have not significantly adopted improved agricultural technologies

Ho_2: Farmer specific and institutional factors do not have significant influence on adoption level of agricultural technologies among FADAMA rice farmers in Enugu State

Ho_3: Socio-economic characteristics of FADAMA rice farmer's cooperative members do not have significant effect on adoption level of agricultural technologies among FADAMA rice farmers in Enugu State

Ho_4: Inadequate extension services, cost of adoption, market value of rice, and illiteracy are not significant hindrances to adoption of improved agricultural technologies among FADAMA rice farmers in Enugu State.

1.6 Justification of the Study

According to Bello (2004), the ultimate goal of the government is to move the Nigerian farmers from basic subsistence production level to surplus agriculture. This dream, if pursued to reality, would indeed be a welcome development, especially as FAO (2002) has observed that in Nigeria, from 1999-2001, the population of the undernourished Nigerians stood at 8million. The assertion on astronomic population growth and need for matching resources to sustain the growth, raises more challenges on the issues of sustainable development especially the aspect that places more emphasis on sustainable agriculture, while pursuing this dream of ensuring food security. It was rather too unfortunate to observe that Nigerians had neglected the issue of determinants of adoption of latest agricultural technologies among society. Agwu, Ekwueme and Anyanwu (2008), observed that in the past, development planning in Nigerians, had not given adequate attention to farmers.

One of the ways of achieving millennium goal was by increasing adoption level of available technologies in agriculture among farmers'. To the extension professionals and administrators, according to Ohajianya and Onu (2005), updated information on findings in various fields of agriculture on determinants of level of adoption has to be released to them. Among these studies Kuponiyi (2000), Bereh (2002), Ewuola and Ajibefun(2002), Hilaid (2006) and Oladimeji (2006), on radio farmer programme, none attempted to investigate into the issue of determinants of level of technology adoption and its farm profitability and productive efficiency. Since none of these studies was on the determinant of level of adoption of agricultural technologies by FADAMA rice cooperative farmers', this study therefore will be justified to serve the purpose. Agricultural productivity must be influenced by the farmers attempt to be mindful of those determinants they consider important in adopting any innovation or technology.

The findings will provide the guide for appropriate government, policy makers on policy concerning FADAMA rice farmers, farmers cooperative and individual farmers. The study will help the ADP to know how to improve standard of living by the people in the study area. Above all, identification of the determinant factors for this study will maximize technology adoption efficiency and effectiveness, thereby leading to increasing in food production in Enugu State, Nigeria and sub-Africa.

1.7 Scope of the Study

The research covered the three agricultural zones of Enugu State especially those towns/communities that are involved in FADAMA rice production. The unit of analysis was cooperative farmers who have been into cooperative for over three years and participated in FADAMA programme. Content scope included extent of adoption, determinants of adoption and constraints to adoption.

CHAPTER TWO

LITERATURE REVIEW

The literature of this study was reviewed under the following headings.

2.0. Conceptual Review

2.1. Concept of Rice

2.1.1. Rice production

2.1.2. Rice processing

2.2. Concept of FADAMA

2.2.1. Importance of National FADAMA Development Project

2.2.3. Conflict over the use of FADAMA resources

2.3. Concept of Adoption and Innovation

2.3.1. Factors Determining the Adoption of Innovations

2.3.2. Adoption and its Model

2.3.3. The Innovation Decision Process.

2.4. Role of Extension in Information Dissemination Function

2.4.1. Agricultural Extension and Adoption Behavior Of Cooperative Members.

2.4.2. Factors Associated with the Effectiveness of Nigerian Extension Service.

2.5. Agricultural Cooperatives as Facilitators in Adoption of Agricultural Innovations.

2.5.2. Influence of Socio-Economic Profiles of Farmers on Agricultural Innovation Adoption

2.6. Concept of Agricultural Technology

2.6.1. Technological change Agricultural Development

2.7. Agricultural Communication and Information System.

2.7.1. Mass Media in Agricultural Information Dissemination Function

2.8. Empirical Review

2.9. Theoretical Framework

2.9.1. Different Types of Collective Action.

2.0 Conceptual Review

2.1. Concept of Rice

Rice is the seed of the grass species *Oruza Sativa* (Asian Rice) or *Oryza glaberrima* (African rice). As a cereal grain, it is the most widely consumed staple food, for a large part of the world's human population, especially in Asia. There are many varieties of rice, and culinary preferences tend to vary legionary. In some areas such as the far East or Spain, there is preference for softer and sticker varieties. There are different varieties such as Sipi, Faro 14, Awilo, mass, IR68, E4077, E4334, Ofoda rice, Toma BG79, BGB24, Agbede.

We have:

1. Lowland, rain-fed which is drought prone, favours medium depth, waterlogged, submergence and flood prone.
2. Lowland irrigated, grown in both the wet season and the dry season.
3. Deep water or floating rice.
4. Coastal wetland.
5. Upland rice also known as Ghaiya rice well known for its drought tolerence.

African rice has been cultivated for 3500 years. Between 1500 and 800BC. *Oryza glaberrima* was propagated from its original centre, the Niger River Delta, and extended to Senegal. African rice helped African conquer its feminine of 1203 (NRC, 1996). According to Juliano (1993), the detailed analysis of nutrients content of rice suggest that the nutrition value of rice varies based on a number of factors.

a. the strain of rice that is between white, brown, red and black (or purple) varieties of rice each prevalent in different parts of the world.
b. the nutrients quality of the soil rice is grown in, whether and how the rice is polished or processed, the manner it is enriched and how it is prepared before consumption (Juliano 1993) conditions. Once the rice grains develop the water in which they grow must drain so that you can harvest and after the harvesting and milling processes you can eat the rice.

Rice crops can be either direct seeded or transplanted. In direct seeding, seeds are sown directly in the field, while transplanting, seedlings are first raised in seed beds

before they are planted in the field. When choosing the suitable planting method, you should consider the following; locality, type of soil, rice ecosystem and availability of inputs and labour. Choosing when to plant is crucial to establishing the crop in the field. Timely planting a well prepared seedbed will help produce a fast growing uniform crop that will have higher yields and better competition against weeds and other pests. The best time to plant depends on locality, variety, weather, water availability and the best harvest time. Planting at the same time (or within a 2week window) as the neighb0ouring fields can help to minimize insect, disease, bird and rat pressure on individual fields. Direct seedling requires 60-80kg of seeds per ha, while transplanting only requires 40kg ha at 2 plants per hill.

2.1.1 Rice Production

According to Iwena (2012), rice production involve a lot of farming practices such as:

i. Land preparation: This is done either manually, using cutlass to clear the bush and remove stump and hoe to make ridges or mechanically by ploughing, harrowing and ridging.
ii. Climate and soil requirement: Rice requires a temperature of over 20^0C, 75cm-120cm of rainfall for upland rice and above 250cm for swamp rice, and light fertile soil.
iii. Method of propagation: Rice is propagated by seed. Rice can be propagated manually or mechanically.

Seed rate: 65kg/ ha at two to three seeds per hole.

Planting date: Rice is planted in Southern Nigeria around April and May and between August and September in the North.

Planting: rice can be planted by broadcasting, sowing or drilling of the seeds at 2-4cm deep.

Nursery Practices: Swamp rice requires nursery which is done in fertile, water-soaked soil. Seeds are broadcast and germination begins after four to five days and the seedlings are transplanted to the field at between seven to eight weeks of growth. Seeds sown in nursery around May-June and transplanted in July-August to

the field. The spacing 25cm-30cm apart depending on variety. The cultural practices include supplying and thinning, and this can be done where applicable. Fertilizer is applied per hectare at planting by broadcasting. Weeding is done to ensure rapid growth of rice. Pests and disease should be prevented or controlled by spraying with appropriate chemicals. Rice matures in four to seven months depending on the varieties. Harvesting is done when the red heads of rice are cut off with knife, sickle or combined harvester.

2.1.2 Rice Processing

The stages in processing rice, include;

i. Sun drying: which is done immediately after harvesting for three to four days.
ii. Threshing is the separation of the grains from the stalk by either beating with stick, treading with feet or by the use of mechanical threshers.
iii. Winnowing is done after threshing. The chaff or unwanted dust and remains of the stalks are removed by winnowing. This is a fanning operation usually done by throwing the grains in the air to blow away the dust and other residues. After winnowing, the grains of rice remain enclosed by the husk to form what is called paddy.
iv. Parboiling is the process used to reduce the breakage of grains during pounding. It also brings some vitamins to the outer layer of the grains and it also reduces the labour required to remove the husks. The paddy rice is heated by putting it into boiling water for about 12-15 hours. The rice swells and the husks are forced apart. The parboiled rice is now sun-dried.
v. Hulling is the removal of the husks from the grains. The grains are pounded gently to remove the expanded husks. The husks are then separated from the rice by winnowing.
vi. Polishing: In some cases, the paddy rice is threshed by machine and polished. Polishing involves the use of specially designed machines to remove the husks and other layers covering the grains. The portion removed is known as rice bran which is very rich in protein and vitamins.

Consumption of polished rice may cause vitamin deficiency disease called beri-beri due to the removal of the bran rich in protein.

vii. Storage of rice can be done as paddy rice or in processed form in silos or jute bags.

There is also pests and disease of rice such as birds, rodents and rice weevils, while disease are rice smut, rice blight and brown loaf spot.

2.2. The Concept of FADAMA

FADAMA Agriculture, according to World Bank report (1996), has been described as flood plains water, similar in some respect to irrigation water naturally supplied. Flood passes over the surface of the land, and water is absorbed by the soil and stored for subsequent use by the plant. In some regions, agriculture encourages peasant farmers to practice irrigated agriculture along the bank of the river, during the dry season when the river is flooded.

FADAMA land is a Hausa word already adopted by the World Bank. It simply means land that is flooded during rainy season. (Baba and Singh, 2008). It refers to low lying swampy area consisting of fluvial deposit and containing extensive exploitable aquifers (Ghandi and Raja-shakara, 2009). In agricultural usage, however, the word FADAMA commonly refers to all low lying relatively flat areas either stream less depressions or adjacent to the seasonally or pre-rennially-flowing streams and rivers. According to some researchers, FADAMA means the seasonally flooded or floodable plains along the major savanna rivers and/or depressions on the adjacent terrace. The word FADAMA is in contrast to *tudu* which means the upland.

National Fadama Development Project NFDP II (2003) reported the benefit of FADAMA Agriculture programme to include:

i. Increased the asset base of the participant

ii. Increased the income rates, as well as changed the standard of being FADAMA farmer,

iii. Increased the level of technical efficiency of the farmers, increased the training and knowledge of the participant in low an irrigation farming and

iv. Increased the supply and availability of food production all over the year. The report finally submitted that the programme has a positive impact on the farmers and has given them a wide potential of alleviating poverty in the country.

In Nigeria, the need to increase food production to feed the ever increasing human population and to diversify the export base of the country is more recognized now than ever before. This has turned the attention of both farmers and government to the exploitation of FADAMA lands, which are believed to have more agricultural potential than the associated upland soils, (Kparmwang & Esu, 1990; Singh & Babaji, 1990). The importance of FADAMA stems from its high level of moisture (ground water and residual moisture) even during dry season. Water table is close to the soil surface thus endearing FADAMA lands to farmers and making it a site of busy agricultural activities throughout the year (Singh, 2009).

FAO (2006)pointed out that in South-Western Nigeria, vegetables such as amaranthus species, sokoyotoko, pepper, tomatoes, and okro are very popular and farmers involved in the growing this make some profit during dry season. The motive to grow vegetable in the FADAMA land is principally to make gain at a time of dry season. Farmers get an advantage over many others who have access to farm with yearly supply of moisture to aid crop production.

Hugus (1997) reported that the benefits derived from growing crops on the flood plain are:

i. Extension of land under cultivation and of the cropping period
ii. Use of the labour force available at the end of the rainy season and the beginning of the dry season,
iii. Exploitation of national fertility derived from alluvial deposits,
iv. Also crop grow on receding flood supplement the poor rain-fed harvest.

Sandra and Agro (1996) pointed out that the development of FADAMA agriculture will not only provide income to farmers but also make significant impact on the drive towards self-sufficiency in food production. The land irrigated can be cropped extensively during rainy season, as well as during the dry season, thus

making the land much more productive off season production of various food crops and vegetables which command better price than those produce during the traditional growing season.

Oluwasanmi (1996) pointed out that FADAMA offer one of the possibilities of increasing agricultural production and that food security will be severely compromised by variability and change in many African countries. Over 95% of African agriculture depends on rainfall. In some countries, yield from rain-fed agriculture could fall up to 5% by 2020. Changing rainfall patterns and higher temperature are reducing agricultural yield leading to new infestations of pest, decreasing fisher's resources that are essential for some rural live hoods and increasing the frequency and flash floods affected more than one million across at least 17 countries in West, Central and East Africa (Ekong, 2006)

Nigeria is faced with the challenges of providing adequate food supply for its teeming population. With a current population of about 140 million (NPC, 2006), FAO has consistently listed Nigeria among countries that is technically unable to meet their food needs from rain-fed agriculture at low level input. Furthermore, the devastating effect of desertification and drought in the last three decades on the dry sub-humid and semi-arid agro-ecological zones of Nigeria have made Nigeria Government to embark on massive investment in small-scale irrigation (Ekong, 2003). The growing demand for food coupled with seasonal variations, unpredictability that have characterized the pattern of rainfall in the sub-humid and semi-arid agro-ecological zones of Nigeria have necessitated the supplementation of rain-fed agriculture with irrigation (Iheanacho, Abaja and Harina (2007).

Sandra *et al* (2006) pointed out that the development of FADAMA agriculture will not only provide income to the farmers but also make a significant impact on the drive toward sufficiency in crop production. The land irrigation can be cropped extensively during rainy season, as well as during the dry season, thus, making the land much productive off-season for production of various food crops and vegetables. These farm products normally command better price than those produced during the traditional rain fed growing season. FAO (2006) pointed out that in the south-western Nigeria, crop and vegetables such as rice, maize and

amaratus species, tomatoes and pepper are very popular, and are growing in dry season to make more profit. The motive to grow crop and vegetables in the FADAMA land is principally to make gain at a time of dry season.

2.2.1 Importance of National FADAMA Development Project

The NFDP was introduced as a strategy to tackle rural development problems. There are quite a number of studies on rural development in general, and FADAMA project in particular. These studies have been carried out in different parts of Nigeria and on different aspects of the impact analysis of the National FADAMA development Project. Bajoga and Adebayo (2006) examined the impact of the project specifically on the living standard of dry season farmers who benefited from the FADAMA loans in Gombe State. The study revealed that the project did not make any impact on the beneficiaries of the FADAMA loan by increasing their income, improving the living standard of an access to more personal belongings.

Correspondingly, Adegbite, Oloruntoba, Adubi, Oyekunle, and Sobanke (2008) carried out an assessment on the impact of FADAMA II on small scale farmer's income in Ogun State with emphasis on the implication for agricultural financing in Nigeria. Using a multi-stage stratified random sampling in their study, three villages were selected each for both beneficiaries and non-beneficiaries in FADAMA endowed communities of Obafemi-Owade Local Government Area of Ogun State.

Evidence from their study also revealed no significant increased in the income of the FADAMA beneficiaries compared to non-beneficiaries of the FADAMA project in the study area.

In another study, Kudi *et al* (2008) examined the impact of the FADAMA II on poverty alleviation among farmers in Giwa Local Government Area of Kaduna State, especially how the project has affected the socio-economic status of the farmer and production efficiency. They found that there was a little improvement in the income of farmers. The implication is that better income give better purchasing power and hence the improvement of living standard.

Adeoye, A., Yusuf and Carim-Sanni (2011) also undertook a study to examine rural infrastructure and profitability of farmers under FADAMA II project in Oyo State, using infrastructural index and gross margin. They compared the infrastructural development between FADAMA II Local Government Areas and non-FADAMA II areas. Their findings revealed that, more than half of the villages in FADAMA II Local Government Areas have more infrastructures than non-FADAMA II villages. This implies that FADAMA II project had contributed significantly to the development of infrastructures in Oyo State.

The cross sectional studies as shown above have exposed that societies are subject to a process of development, which is itself not arbitrary, but regular; and that no social fact can be really understood apart from history.

2.2.3 Conflict over the Use of FADAMA Resources

Small-holder agriculture is the dominant occupation of rural Nigerians which is mainly rain fed and characterized by low land and labour productivity. Yet, Nigeria has a potential comparative advantage in the production of a variety of fresh and processed high value crops, especially vegetables during the dry season and livestock product (meat and milk) and fisheries products throughout the year. This is because the country is endowed with underground and surface water reserves, rich pastures, favorable agro ecological conditions in the country's low-lying plains with alluvial deposit called FADAMA. The desire to realize the full potential of FADAMA resources in Nigeria led to the design of the National FADAMA Development project, mainly funded by the World Bank, with counterpart funding by the Federal and benefiting State government. The FADAMA I and II projects successful refined approaches for improved utilization of these lands. FADAMA II is implementing an innovative local development planning (LDP) tool and building on the success of the community-driven development mechanisms.

The cumulative impact of these earlier successful Bank-assisted projects attests to the robustness of the small-scale and community-based approach to FADAMA development in an environmentally sensitive manner. The FADAMA III

operation will support the financing and implementation of five main components designed to transfer financial and technical resources to the beneficiary groups in

i. Institutional and development
ii. Physical infrastructure for productive use
iii. Transfer and adoption of technology to expand productivity, improve value-added, and conserve land quality
iv. Support extension and applied research; and
v. Provide matching grants to access assets for income-generation and livelihood.

The project initial implementation is for period of five years, (July 2008 to June 2013) but was extended to 2017. It closed in December 2017. The project was anchored on the CDD approach. Community organizations decide on how the resources are being allocated among all priorities that they themselves identify and they manage the funds. Extensive facilitation, training, and technical assistance were provided through the project to ensure that poor rural communities, including women and vulnerable groups, especially the physical challenged, participate in the collective decision-making process. The project helped by giving voice to the communities, as well as promotes the principals of transparency and accountability in planning and management of public investments within the Local Government Areas.

Ejiofor (2007), cited in Ibeawuchi and Nwachukwu (2010) explained that the CDD strategy makes it possible for beneficiaries to play leading roles in:-

a. Identification and prioritization of their needs;
b. Deciding and preparing of micro-projects required to address the identified needs;
c. Co-financing the micro-projects;
d. Continue to operate and maintain the micro-projects thereby ensuring sustainability;
e. Learn to do things for themselves and in so doing their capacities are built; and

f. Ownership of the micro-projects is guaranteed by active participation of beneficiaries in all the phases of the micro-projects cycle (identification, planning, prioritization, designing, implementing and maintenance of intervention measures)

The main strategic choices made in the project design include the following:

a. **To address constraints to productive infrastructure:** inadequacies in rural infrastructure and essential support service, road access and dry season irrigation, and availability of relevant agricultural and land management technologies constrain growth and adoption of more sustainable approaches to land management. The core activities funded by this project address this constraint.

b. **To improve livelihood opportunities:** the project supports productive activities, technical assistance and investment in assets and land quality and services identified by communities as relevant to generation of higher incomes and better livelihoods.

c. **To empower the rural poor:** the poor lack power and voice to access basic services identify opportunities, and exercise legal rights. Information is scarce. Household, village, and local government decision-making processes are often opaque and exclusionary. Mechanisms to ensure accountability in delivery of State and Local Government services are weak. The project's facilitators working with the FADAMA groups will help them overcome barriers deriving from lack of knowledge or insufficient cooperation among groups.

d. **To promote socially-inclusive and community-based approaches:** integration of social inclusion and community-driven principals has proven to be cost-effective, responsive to local priorities and effective in reducing conflicts over use of natural resources. This proven approach has demonstrated that the key or solution is to promote investments that bring both private profitability and public benefits.

e. **To accord adequate attention to technical quality assurance:** limited capacity in supervising the technical aspects of community sub-projects contributed

to delay in implementing local development plans and sub-projects funded under the FADAMA II project. The FADAMA development facilitators and service providers will receive adequate training before they are deployed in the communities. The facilitators' training program will be designed to increase their sector-specific technical skills and provide them with the skills to perform feasibility work and technical supervision with the participation of the farmer groups. The Agricultural Development Program (ADP) offices will train the service providers.

The project coverage is national. It include the 19 States that did not benefit from the ongoing IDA FADAMA II Project and the FADAMA II States that meet the eligibility criteria for continued participation, including:

i. Satisfactory disbursement performance as indicated by at least 75 percent of the IDA credit disbursed by appraisal of the proposed FADAMA III project.
ii. Demonstrated pro-poor impact from the resources disbursed directly through community sub-projects (as indicated by impact evaluation and beneficiary assessment studies, including the mid-term review (MTR) of FADAMA II project
iii. Establishment and funding of the operations of the core teams of the State FADAMA Coordination Offices (SFCOs) and
iv. Commitment to the project as demonstrated by payment of counterpart contribution towards the costs of the project preparation work and implementation. The project covers up to 20 Local Government Authorities (LGAs) for the 19 States that did not benefit from the FADAMA II operation. In the FADAMA II States, up to ten 4 LGAs are added to the ten LGAs that have already benefited. The GEF support will focus especially but not exclusively on the States of Borno, Cross-River and Osun, selected by the Government's newly founded National SLM Committee for their ecological and geographic diversity. The beneficiaries were assisted to organize themselves in economic interest groups, named FADAMA User Groups (FUGs), each having on average around 20 members (plus these individuals' households). The FUGs establish FADAMA Community

Associations (FCAs), which are apex organizations of 15 FUGs on average at the community level.

Since time immemorial, societies have always had conflict as an abnormal situation while it's opposite (consensus) is the normal fact of life. Conflict is viewed as exceptionally destructive, hence abnormal and pathological (Saiad, 1999). Whether conflict is viewed as abnormal as upheld by various schools of thought in sociology, all societies have developed mechanisms for dealing with or managing conflict between individuals, groups/families and communities or even nations.

The use of natural resources by many rural stakeholders in an institutional setting characterized by lack of clarity and security of property rights inequitable access and lack of transparency had led to serious conflict on FADAMA (World Bank, 2001). Violent confrontations resulting to physical injuries and destruction of property have been reported in Bauchi, Gombe, Jigawa and Imo States. These clashes from pastoralists and FADAMA farmers claimed of encroachment by the later on track routes, grazing areas and watering points and subsequent destruction of field crops and FADAMA facilities like wash bores by cattle (World Bank, 2003).

Miyeti Allah Cattle Breeders Association (MACBAN) a non-governmental organization protecting the rights and well being of pastoralists in 2000 asserted that the prolonged period of neglect by government has adversely affected their wellbeing, in terms of loss of grazing reserves, stock routes and watering points to sedentary farmers, grazing animal mortality rates due to lack of veterinary care and extremely high illiteracy among pastoralists family (World Bank, 2001).

MACBAN in Adamawa State revealed that most of the destruction done on farm lands was carried out by migrant herders from neighbouring countries. World Bank (2003) reported that besides the farmers/pastoralists conflicts, there are other resource users of FADAMA such as hunters and gatherers of edibles and non edible FADAMA resources whose prolonged neglect and selfish exploitation of FADAMA resources by the main users (farmers/pastoralists) could engender conflict. Garba (1995) also asserted that the FADAMA are cool and refreshing

environment, that are good relaxation especially during fasting periods for Muslim who needs to be considered in resources exploitation.

FADAMA are flood plains and low-lying areas underlined by shallow aquifers. Put in another form, FADAMA could be described as 'wetlands' in the land or lowland around a river that flood or becomes wet when the river is high. The lands often have large deposits of organic matter and soils richer than the surrounding top lands. While these lands are relatively small compared with the overall available area, the FADAMA lands have the potential for extended seasonal use and provide the opportunity for production diversification (Rogers and Ingawa, 2004).

2.3. Concept of Adoption and Innovation

An adoption process is different from diffusion which concerns itself with the spread of innovation throughout the entire social system. Adoption directs attention on bringing over behavioural change; that is adoption or rejection of new ideas (Valente and Rogers, 2009). The adoption of improved practices involves a transformation orientation and behavior of the farmer from the time he is aware of a new practice to that of its continuous use or rejection. Adoption may be explained as a decision to make full use of a new idea or practices as the best course of action among alternatives. Rogers (2003) regards adoption as the full scale integration of a new idea, product and practice into an on-going operation. (Valente and Rogers, 2009) contend that is a mental process through which an individual passes from first knowledge of an innovation to a decision to adopt or reject and to the confirmation of this decision by continuous use.

The concept "innovation" ordinarily implies something new. And with this, it is obvious that the newness indicates to some extent, a strandeness of the ideas. Adekayo and Tologbonse (2005), Valente and Rogers, 2009 defined an innovation as "an idea, method or object which is regarded as new by an individual", but which is not always the result of recent research.

All technologies, ideas and practices have origin or starting point (which could be from the research stations or farmers) and will be treated as innovation in domain until its popularity is overwhelming.

Thus, the concept is a description of the newness and this decline with time and across space until it becomes common and loses the name.

Improved seed varieties, agrochemical and fertilizers are examples of agricultural innovations. Technologies, according to Deji (2005) are the application of knowledge for practical purpose, which is generally use to improve the condition of human and natural environment and carry out some other socio-economic activities. It is also considered a complex blend of materials, process and knowledge. Innovation and technology are to be taken as synonyms (Rogers, 2003; Wejnert 2002).

Innovation is classified into two: material innovation (hardware) component like improved seed, tractor and knowledge-based innovation (software component) e.g. planting date, planting space. According to Banyte and Salickaite (2015), Innovation connotes ideas, skill and knowledge introduced to bring about a change in solution to existing problems. It can be perceived, hence he described innovation as an idea or practice perceived by an individual. It refers to a wide range and multiple faced social activities that embrace the entire chain of scientific research and technological development, from the basic laboratory investigating to the marketing of the new product.

According to Les (2009), an innovation whether conceived from the technological social, political economics or administration dimension brings change. In the height of this, he further asserted that innovation embodies the following:

- Identification of needs or problems that were neglected.
- Adoption of corresponding goals towards solving the problems.
- Adoption of the unique methods and strategies towards achieving the objectives and utilizing of human and material resources toward achieving the objectives.

- Making periodic assessment of the entire program to obviate the crises of natural tendency of status quo reduction.

CONCEPTUAL FRAMEWORK

A SCHEMA FOR DESCRIBING AND ANALYZING FARMERS ADOPTION OF IMPROVED AGRICULTURAL

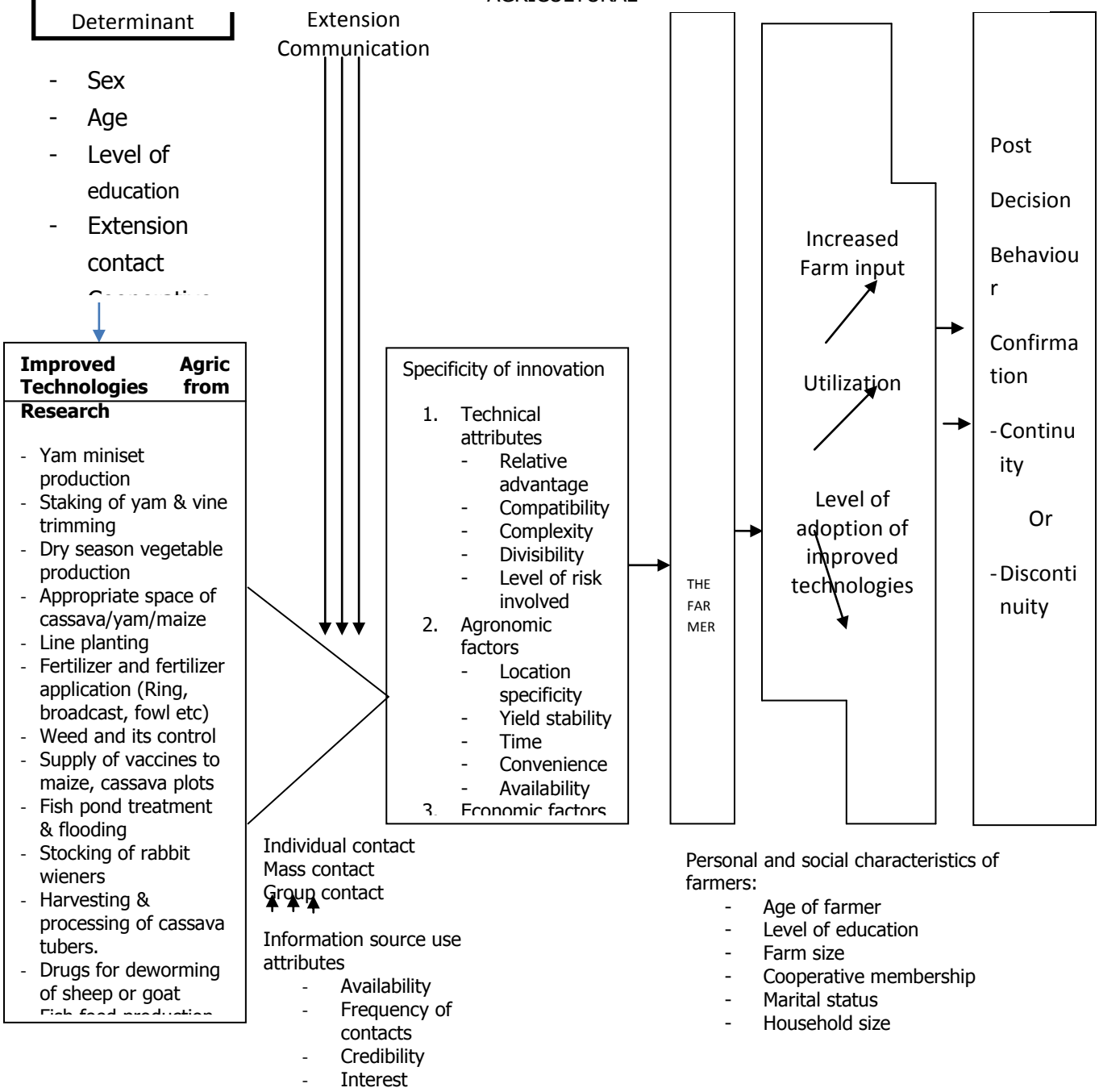


Figure 1: A SCHEMA FOR DESCRIBING AND ANALYZING FARMERS ADOPTION OF IMPROVED AGRICULTURAL

2.3.1 Factors Determining the Adoption of Innovation

Findings conducted outside Nigeria by Doss (2003), Conley and Udry (2000), Mazher *et al* (2003) and Oladele (2006), indicated generally that age, years of farming experience, educational level of farmers, profitability of programme, characteristics of infrastructure, values, beliefs, culture and attitude which every society holds were major factors which influence adoption behaviours of farmers. Studies concluded within Nigeria by Adebayo and Tologbonse (2005), Akinola, Adeyemo and Alene (2011), Uwakah (2005), Ewuola and Ajibefun (2002), Oladimeji (2006), and Pur and Gwary (2008), found that significant variables influencing adoption behavior of farmers were education, age, contact with change agents, occupational status, profitability of programmes, social organization, farm size, family size, farm income and access to market facilities. According to Mgbada (2010), apart from the individual's characteristics, the major factor that affects the adoption of any innovation is the characteristics of the innovation itself. This include;

a. Relative advantage: This has been defined as the degree to which an innovation is superior to the one it is meant to succeed. This may be expressed either in economic or social. For instance, manual processing of oil palm fruits is time consuming and inefficient. A farmer who is presented with a machine that can process palm fruits a matter of minutes and produce more oil per unit measure of fruits would seem to be of a greater advantage than band processing.

   It must be emphasized that although each innovation has its advantage(s) unless a people perceive this advantage to be relatively superior to their current practice, the innovation will not be adopted.

b. Cost: An innovation may be perceived as having advantages over the current used practice but may not be adopted because of it cost. Generally, the higher the cost of an innovation the more slowly it is adopted.

c. Complexity: This refers to the degree to which an innovation is relatively difficult to understand or use of innovations that are relatively simple to understand and use will tend to be more readily adopted than those that are

complex. For example, among Nigerian farmers keeping of farm records is complex than a new variety of seed or fertilizer. Thus, while farmers are adopting this physical innovation very few have adopted the keeping of farm records.

d. Visibility: Innovation varies in the extent to which their results or operation are easily seen. That is visibility. However, banking of money is a less visible innovation. The farmer knows where the bank is located and for the first time he goes to deposit money there, he may come out feeling defrauded. Apart from the paper-work which is entailed in the deposit and withdrawal of money in the bank, the farmers feel more secure seeing his money everyday hence he is more reluctant to adopt saving with the commercial bank or taking an insurance policy.

e. Divisibility: This refers to the extent to which innovation can be tried in parts or in a limited scale. A farmer can try a new fertilizer on one or two stands of his corn. Similarly he can plant a small portion of his field with the new variety of tomatoes and watch its performance, while continuing with the older variety. If he finds the new variety good enough he may then decide to adopt it.

f. Compatibility: This refers to the extent to which an innovation is consistent with existing values, norms and past experiences of the adoption. For example, the Western Nigerian farmers accepted the NSI maize variety when it was first introduced. They liked the increased in yield which they recorded during the first year of harvest but most of them refused to plant this variety the following season simply because the pap which was produced with this high yielding maize tested different and had the type of colour which was not consistent with what pap eaters in the area were used to and so farmers could not sell the extra harvest which they now recorded.

A nutritionist trying to introduce pork to a Muslim house-wife will not succeed because this particular source of protein is not accepted by the particular religious community.

When an innovation conflicts with the existing behavior, it can be rejected outright or the existing values may be adjusted to accommodate the innovation or people may simply rationalize the acceptance of the change.

2.3.2 Adoption and its Model

Adoption is the process by which an individual accepts to use innovation or technology after due consideration of its merits and demerits. The initial step towards the adoption of new practice is that the innovation is available to the farmer. Valente and Rogers(2009) Stated that adoption is a decision to make full use of new idea as the best course of action available over a period of time. This is why an innovation can be accepted or rejected after adequate consideration has been made. The adoption process consists of five stages or steps (namely: awareness, interest, evaluation, trial and adoption) that an individual goes through in adoption of innovation/Technology.

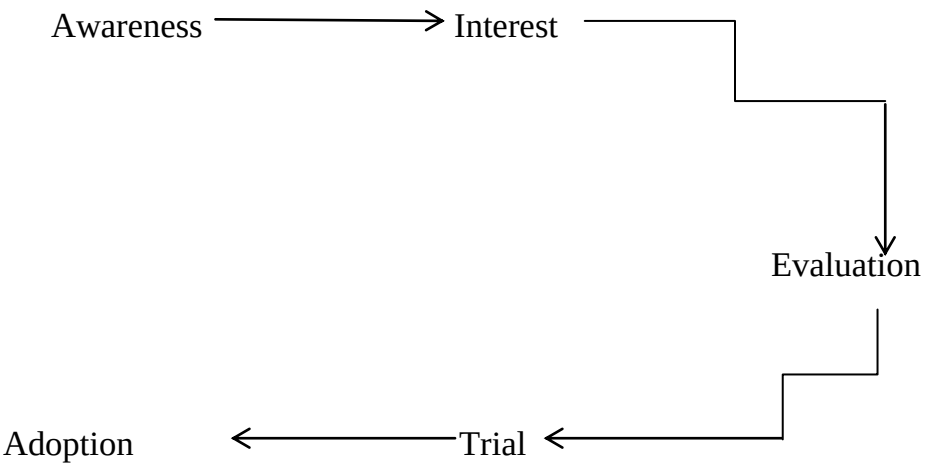


Figure 2: The stages of adoption process

Awareness:- the farmers needs to hear of the new technology. He gets information from mass media, friends and neighbours key informants etc. This stage is associated with (new/additional information). He lacks sufficient information.

Interest:- the farmers develops interest and actively seeks further information. He gets more information by asking for it. This can be achieved through group meeting, group discussion, radio forums, farm visits etc.

Here information strengthening and attitude building are his goal. He gets interested in cost etc. and how it will affect him. There is increase in knowledge.

Evaluation:- the individual weighs up the advantages and disadvantages of adoption of the new technology by going through mental assessment by asking himself questions such as "is it worth it", 'can I do it' etc. The farmer needs to be assured that what he heard and saw are indeed workable. Use of result demonstration, farmer exchange etc. are required. This stage is associated with increased skill.

Trial:- It is usually experienced by individual that decide to accept the innovation/technology and the testing of the innovation on a small-scale to determine the relevance and usefulness of the innovation/technology. Trial stage answers questions on evaluation and is associated with behavioural change. It involves on farm trial, farmer exchange demonstration etc.

Adoption:- This is final stage when the individual applies the innovation on a large scale and continues to use in preference to old method. Recognition of programme, competition, in cooperating practices into farming system is important at this stage and it is associated with attitudinal change. Exposure to certain condition may affect level of adoption (Asiabaka, 2007)

2.3.3 The Innovation Decision Process.

The adoption process can be conceptualized to show the course and effect relationship in the new innovation decision as shown in Fig 3.

Communication sources

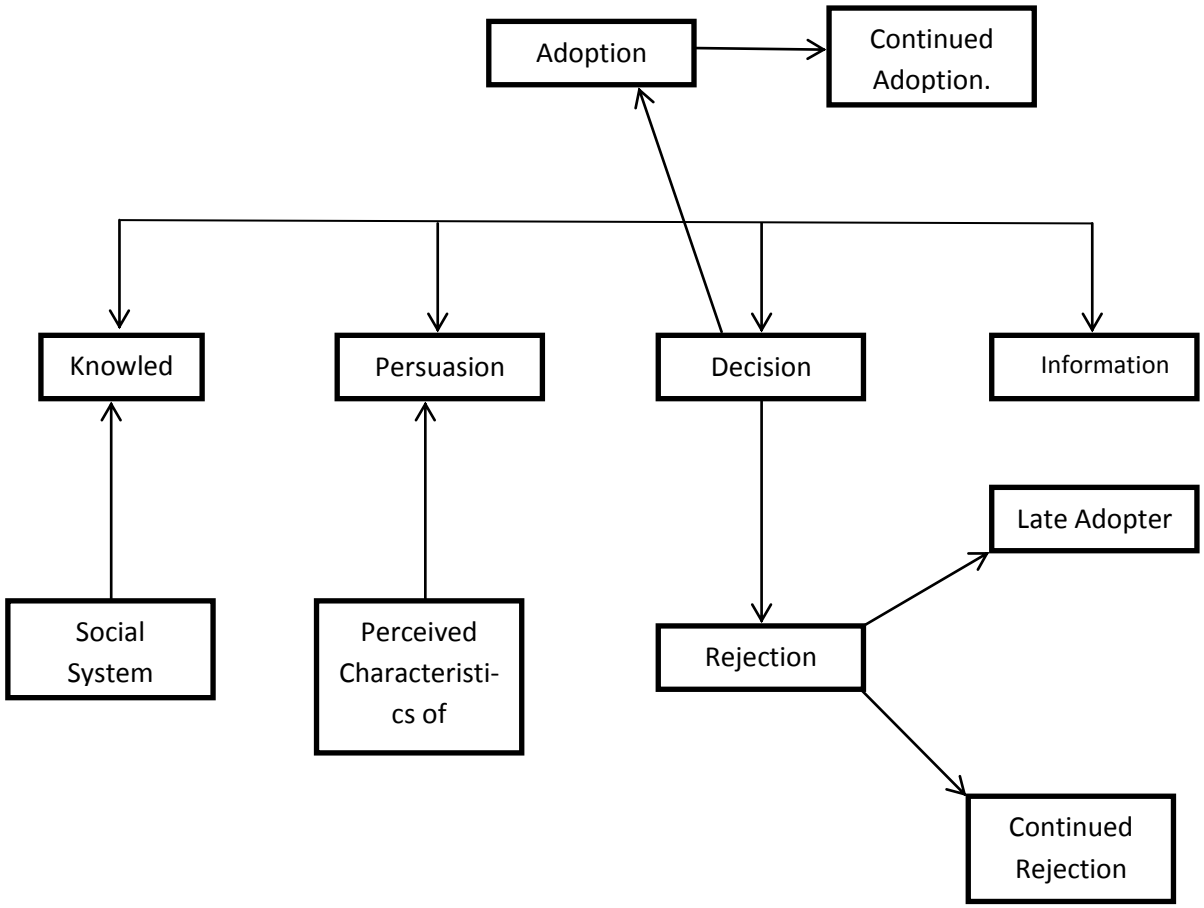


Figure 3: Conceptualized to show the course and effect relationship in the new innovation decision

The bottom line of the above model is that effective conversion of ideas, innovations or technologies under normal conditions will precede the adoption of technologies ideas, or innovation. This is what the present study seeks to establish.

The innovation-Decision process as conventionalized by Valente and Rogers (2009), comprises four functions or stages:

1. **Knowledge:-** The individual is expose to the innovation existence and gains some understanding of how it functions.
2. **Persuasion:-** The individual forms a favourable or an unfavorable attitude towards the innovation.
3. **Decision:-** The individual engages in activities which lead to a choice to adopt or reject the innovation.

4. **Confirmation:-** the individual seeks reinforcement for the innovation-decision he has made., but he may reverse his previous decision if exposed to conflicting messages about the innovation. The innovation-decision process is the mental process through which and individual passes from past knowledge of an innovation to a decision to adopt or reject and to confirmation of this decision. The model, therefore, is that for a farmer to adopt an innovation, there are variables pertaining not only to him but also related to the innovation and method of information dissemination which influences his responses.

   Adoption of new innovation practices is a function of behavioural change and it is consequent upon the transfer of the technology packages, using appropriate extension delivery mechanisms. The initial or foremost step towards the adoption of a new practices is the knowledge that the innovation are available to the farmers. It is clear that success of an extension service in achieving its objectives depends on extension personnel employing adequate methods like persuasion to teach the farmers to apply the findings of agricultural research to their farm operations. These are effected by variables like social system which include norms, tolerance, etc. and perceived characteristics of innovation like relative advantage compatibility etc.

2.4 Role of Extension in Information Dissemination Function

The role of extension service in increasing agricultural productivity cannot be over emphasized, especially in Africa setting where majority of the inhabitants are involved in agricultural productions and are largely illiterate (Aina 2006). They are, therefore, incapacitated and are not able to benefit from information in print world, which is the most effective way of disseminating information to various agricultural information users especially farmers. Regular and appropriate information needed to be regularly made available to them. The extension worker in a typical African setting performs the role of disseminating agricultural information to farmers through physical contact. Unfortunately, the ratio of extension worker to

farmer in Africa is abysmally low. Thus, many farmers are not supplied with information by extension workers in Africa.

Egbule and Njoku (2008) noted that agricultural extension service has the main goal of improving the livelihood status of the rural household through increased farm production and productivity. In other to achieve this, the farmers need to be supported with new technology and or scientific information with which they improve their production performance and managerial skill. Adoption and proper implementation of such technologies and or information have a great deal of potential of bringing about productivity gains in agriculture. Therefore, effective communication of new research finding and technologies in agriculture to rural farmers remains a promising strategy for increasing agricultural productivity. Generally such information many include technique of applying fertilizer, insecticides and fungicides to crops, improved method of cultivation soil maintenance, harvesting and storage.

According to Unanma *et al* (2004), the role of extension service complements the role of research through diffusion the innovation from research using appropriate strategies. Consequently, the extension service organization is responsible for reaching and teaching large number of farmers about new and improved technologies and getting feedback to research and other agencies in a timely fashion.

In an attempt to reach farmers with relevant technologies, the extension services employs various methods and approaches for its information message delivery, International Food Policy Research Institute (IFPRI, 2002). The economic multiplier effect of such productivity gain includes increased income, low food prices and slow pace of rural-urban migration. The methods which have come to be known as extension teaching methods are the individual, group and mass media. Each of these methods associated with its advantages and disadvantages can be adopted to serve specific purpose(s) in the extension services. The individual method involve exchange of information between two people on face to face basis, while the group method involves exchange of information between the source and two or more other people in a group formation. The mass method involves

dissemination of information to larger number of people who are unknown to the source of the information through radio, television or print media.

Anaeto *et al* (2012) Stated that Agricultural extension service is the means by which the Department of Agriculture advices and teaches farmers relevant production technologies and keeps in touch with farming conditions and farmers problems and needs. Given these advisory, teaching and information functions an extension service can achieve little without effective communication within the service and between extension workers and farmers.

Echetama (2011) reported that the role of communication is of vital importance in agricultural extension service. To this effect there is no limit to what part the press, radio and television can play.

In the past, fertilizer was an agricultural input factor many farmers never cared to use just because there was a belief and of course ignorance that fertilizer kill crops and that yam produced using fertilizer did not store well and long. The truth about it however, is that if wrongly applied, they will decay. With intensified fertilizer application campaigns, agricultural demonstration plus mass education, people now request for fertilizer on their own.

According to FAO (2011), agricultural extension services are essentially communicative. It has, therefore, been recommended that extension should forge communication link to create network for sharing knowledge and experience since the purpose of communication is to bring about change of attitude, skills, knowledge and aspiration of the receivers (Agwu *et al* 2008)..

According to Ekumankama (2000), sustainable agricultural development will continue to elude Nigeria unless appropriate innovations are effectively communicated to the farming population through agricultural extension services.

2.4.1 Agricultural Extension and Adoption Behaviour of the Cooperative Members.

Adoption of technology involves a process in which awareness is created, attitudes changed and favourable conditions of adoption are provided (Ghosh *et al*, 2005). In other words, adoption is multi-dimensional event and a wide range of factors (such as attitudes, beliefs, perception, personal characteristics and so on)

may affect it. The two decades have seen user adoption, tested, refined. These models have contributed to our understanding of user technology adoption factors and their relationships. Many studies have been conducted on issue of technology adoption based on these models (Ghosh *et al*, 2005; Nsoso and Ramasima, 2004).

However, Rogers (2003) Stated that the adoption of innovation decision process through which an individual passes from first knowledge of an innovation, to forming an attitudes towards the innovation, the innovator deciding to adopt or reject the innovation, implementing the new ideas, and confirming the innovation decision. This implies that agricultural technology innovation can only be accepted by rural farmers when they have passed through the innovation to decision process and these farmers have picked interest concerning this because, when a farmer picks interest, he tends to seek for more information on his own and when this happens adoptions can take place. Adoption models are generally based on the theory that farmers make decisions in order to maximize land. Farmers utility depends on optimizing the productivity and minimizing the cost of cultivation to attain maximum profits. Farmers adopt or practice new technologies when they expect a more profitable outcome that is gained from the existing technology. (Adesope *et al,* 2012)

The importance of farmers' adoption of new agricultural technology has long been of interest to agricultural extensionists and economists. Several parameters have been identified as influencing the adoption behavior of farmers from qualitative and quantitative models for the exploration of the subject. Social scientist investigating farmers' adoption behavior have accumulated considerable evidence showing that demographic variables, technology characteristics, information sources, knowledge, awareness, attitude, and group influence affect adoption behavior. Adoption of innovation refers to the decision to apply an innovation and to continue to use it. (Oladele, 2006)

A wide range of economic, social, physical and technical aspect of farming influence adoption of agricultural production technology. Earlier evidences (Rogers, 2003) led to the categorization of adoption behavior into innovators, early adopters, early majority, late majority and laggards. This is based on validated studies that the

adoption behavior of any agricultural technology would follow a normal distribution curve in a given social system. The increasing importance of rice towards world food security has been stressed through the green revolution in Asia and the increasing consumption of rice among world's poor. Aker *et al* (2010) Stated that although rice is grown by efficiently by small-scale farmers, a successful rice economy needs sophisticated engagements from government to develop the economics of scale and scope that permit a low-cost rice system-an engagement that has largely been missing in West Africa.

2.4.2 Factors Associated with the Effectiveness of Nigeria Extension Service

There are certain factors which are likely to effect the effectiveness of Nigerian Extension Services. Doss (2003) and Agbamu (2005) identified four general types of factors affecting the effectiveness of Nigeria extension as:

- Extension services information source use factors.
- Attributes of the farmer clientele.
- Aspect of the technology packages being advanced by the extension agencies.
- Contextual factors, including political and economic factors that originate outside the local setting, that farmers cannot control.

i. Extension information source use factor.

Studies by Adeyanju and Mbibi (2005), Agbamu (2005) and Ifenkwe and Mejeha (2008) show positive and significant relationship between farmers adoption of farm innovations and frequency of contact with extension service information sources. However, the frequency of use of extension information sources is largely dependent upon source attributes. These attributes include the extent they satisfy farmer interest and information needs, availability usefulness and credibility of information sources, and farmers farm innovation adoption behaviour.

ii. Attitudes of farmers.

The personal and social characteristics of farmers have been found to have a predisposing influence on farmers in acceptance and utilization of farm innovations from extension agencies. Some of these farmers attributes include; age, level of education, socio-economic status, attitude towards change, farm size, situation factors and change agency factors (Uwakah, 2005).

iii. Technology-related factor

Transfer of inappropriate farm technologies is even more harmful than no technology as they have the capacity of stiffening the farmers and making them insensitive to change effort, thereby constraining the achievement of extension, service efforts. The specific technology attribute found to effect farmers adoption of improved farm technologies recommended by extension include:

- Their compatibility with existing farmer practice, profitability, complexity
- Availability, specificity and social value.
- Trialability, observability of benefit of the new idea (Ifenkwe and Meheja 2005).

2.5 Agricultural Innovation Adoption

Innovation as a basis for economic development has been emphasized by Economic Commission for Africa and the United Nations Millennium Project. Innovation can be defined as all the scientific, technological, organizational, financial, and commercial activities necessary to create, implement, and market new or improved products or processes (OECD, 2000). An innovation is an idea, behavior, or object that is perceived as new by its audience and usually, it is seen as an end result of the urge to improve livelihoods and make them more sustainable for economic uses by man. “Innovations around the most basic humanitarian needs are always top priority, but helping communities get back on their feet and start to function as economically-independent units is just as important as emergency aid support” (Michael Pritchard MBE, 2013) The nature and intensity of innovations have over the years improved farmers’ level of awareness, sustainable livelihoods

and consequently reduced the poverty level amongst their households. Being aware of improved production and storage practices will in turn improve their income, health and standard of living. There is no doubt that effective participation by the poor in grassroots projects initiated by government and other private agencies all over the world enhances overall projects performance. Agricultural technology adoption study has many policy implications in agricultural development. It serves as a tool for evaluating the distributional impacts of new innovations, for documenting the impact of an innovation or extension effort, for identifying and reducing the constraints to adoption, and as a research guide to focusing innovation priority (Doss, 2003; Langyintho and Nejybuam, 2008). The rate at which innovations are used by farmers is largely dependent on sensitization, mentoring and demonstration by extension agents (Lawal & Oluloye, 2008).

The work of Lawal *et al*, (2005) conducted in some villages in the South-west Nigeria recorded high adoption rate (about 56.7%) of improved varieties of seeds. Other study in this area (Ekwe *et al* 2006) reported low adoption rate of improved crops technology as a result of low research and extension outreach to farmers. Studies across the country showed that where awareness was high and extension contact was more than 60%, adoption of agricultural technology is usually more than 50%. In their studies, Holloway *et al*, (2007) and Langyintuo and Nejybuam (2008) identified neighborhoods effects as an important factor that can greatly influence farmers' adoption decision. They argue that as farmers make technological choices. They are influenced by the behavior of the neighboring farmers or by agro-ecological characteristics. The wealth status of farmers has also been identified as critical factors influencing adoption. The general belief is that wealth will positively influence farmers' adoption decision. This is because access to more resources increase farmers risk bearing ability (Adekunle *et al* 2005). Doss (2003) share some perspectives on a number of indices that are often used to proxy farmers wealth status. They include livestock ownership, non-agricultural assets, and land holding.

Another interesting characteristic of farmers that could have either positive or negative effect on adoption of agricultural technology as observed in some

adoption literature is the age of farmer. Adesina and Baidu-Forson (1995 share a thought about the expected effect of farmers' age on adoption, arguing that older farmers may have more experience in crop production and be more exposed to the potentials in modern technology than younger farmers. They, however, pointed out that they could as well be more risk averse than younger farmers and have a lesser likelihood of adopting improved technology.

In Nigeria, empirical studies on agricultural technology adoption suggest that factors such as socio-economic characteristics of farmers, access to credit or cash resources and information from extension and other media influence adoption rate of new agricultural technology among farmers (Ayinde *et al*, 2010; Iderisa *et al*, 2012). For example, Ayinde, Adewumi, Olatunji and Babalola,(2010) found that education level of farmers; farming experience; farm size; access to extension agents and access to credit have significant and positive influence on adoption. In the study conducted by Kudi *et al*, (2011), farmers' awareness has considerable influence on the rate of adoption of agricultural innovation.

Oladele (2006) noted that introduction of IMV is not enough without a suitable complementary practices such as planting distance, seed dressing, method of fertilizer application, weed control method and storage technique to aid better performance of agricultural technologies. A number of studies, conducted in various parts of Nigeria suggest some factors (Constraints) that are responsible for low level of agricultural technology adoption (Odoemenem & Obinne, 2010; Kudi *et al*, 2011; Idrisa *et al*, 2012). Some of the major constraints identified are credit facilities, education, extension services, farm size, land tenure system and labour availability.

2.5.1 Agricultural Cooperatives as Facilitator in Adoption of Agricultural Innovations.

Most of the cooperative principles, if actually put into practice, could help in adoption of agricultural technologies by providing some solution to the challenges of the farmers. A principle like the education, training and information can give the women agriculturists the opportunity of some non-formal education which could be

of help in their adoption behavior of agricultural innovation. Some of these supportive activities, in the words of Magaji (2005), show that agricultural societies are involved in many aspects of adoption of agricultural innovations directed at giving the farmers the support to raise their productivity and income level. Marcone (2010) argues that agricultural cooperatives have a lot of dimensions which can aid adoption of agricultural innovations, some of which include:

Land Acquisition: Land acquisition cooperative is a part of agricultural cooperatives which are the result of voluntary land consolidation by individual land owners whose joint efforts contribute to efficiency in agriculture. These cooperatives are formed so that they could be apportioned land for farming especially the dry season women vegetable farmers. Onugu (2008) attests that Ada rice farm is one of such examples, with land developed with irrigation facilities, tractors, implements and access to credit.

Patel and Anthonio (2006) contend that some land acquisition cooperatives are made up of those that are formed for the management of water resources through irrigation and drainage, the installation of tanks, wells and pumps typical of FADAMA programme. The Adani Rice project in Enugu State owes its success partly to these cooperatives. Sabo (2006) reports that this country has greet need and potential of this type of cooperatives because in the Northern part of the country most women participants of Women-in-Agriculture programme use provided boreholes and water pumps for farming. Prakash (2008) gave example of this agricultural cooperative in Pungas (India and Pakistan) where over 500,000 hectares of land had been consolidated on voluntary basis through cooperative efforts. This land acquisition effort of cooperative help women agriculturists a lot because of their cultural restriction in ownership of land as a result of our land tenure system.

Namuisha (2010) confirms that in Tanzania women agriculturists cooperators gain access to fund/capital for conducting their agricultural activities and other income generating activities and hence increase their income and support their families. When fund is available, adoption of agricultural technologies can be considered because some of them can be capital intensive.

Marcone (2010) identified agricultural cooperative as a major facilitator of agricultural innovations. Since cooperatives in their values and principles operate with team work, they carry themselves along, getting all involved irrespective of sex, status, race-no discrimination. Agricultural cooperatives should then be used to solve some problems. For instance, most of the agricultural technologies developed through research and development and extended to rural farmers especially the women are rarely consulted in the planning and development of such technologies which are finally pushed to them in form of take-it-or are therefore, in most cases inappropriate and unsuitable for efficient agricultural production. According to ENADEP (2008), such research as has been done in Africa on tropical crop production, soil (conservation) regeneration have wrongly presumed the availability of chemicals, water supplies, and of a basic scientific and technical knowledge on the part of farmers.

2.5.2 Influence of Socio-Economic Profiles of the Farmers on Agricultural Innovation Adoption.

Okeke (2000) observed that the enactment of the cooperative ordinance in 1935 marked a turning point in development of the cooperative movement in Nigerians, and that the movement did not only gain its legal footing from the ordinance, it also was conceptualized as an important instrument and strategy for agrarian development. Okeke further said that cooperative play crucial role in Nigeria as it relates to solving most of the bulk of producer's problems in Nigeria. He and others have in the past noted that cooperative play multi role as an institutional framework for allocating scare resource, stimulating economic growth and enhancing welfare. Cooperatives have also through provision of income earning opportunities raised the income level of the people as well as serving as a training ground for entrepreneurship and mobilization of material resources for economic transformation. He concluded by saying that cooperative have the means to deal with the whole problems of deprivations in the following ways:

- Establishment of small-scale enterprises.
- Strengthening market and processing cooperative.

- Establishment of cooperative housing societies.
- Setting up of consumer cooperative societies.

Ugwuanyi (2000), contends that cooperatives in Nigeria are generally viewed as instrument of rural development. She further said that cooperative could help to improve the rural dwellers economically, socially, health wise and finally education. Agricultural cooperatives play significant role in provision of service that enhances agricultural development by serving as a medium through which services like inputs, farm implements farm mechanization, agricultural loans, agricultural extension, members education marketing of members farm produce and other economic activities and services we rendered to members. Uchendu (2000) noted that regular and optimal performance of the role will accelerate transformation of agricultural and rural economy development.

Okechukwu (2002) pointed out that role of cooperative in agricultural development generally includes provision of farm mechanization services, giving information on storage facilities and market service to members. However Ugwuanyi (2000) observed provision of credit and improvement of agriculture as the widespread or major activities of the majority of registered cooperative societies.

2.6 Concept of Agricultural Technology

According to Torimiro, Kolawole and Okorie, (2007), technology is taken to mean not only machines and equipment but also the skills, abilities, knowledge, systems and processes necessary to make things happen. Thus, technology is meant to be total systems that include know-how, procedures, goods and services. Some of the identified improved technologies include fertilizer, fungicides etc. Technology is application of knowledge for practical purposes (Echetama, 2011).

-Generally, technology is used to improve the human environment or to carry out other social economic activities. Technology can be classified into two major categories:

i. Material technology such as tools, equipments, agrochemicals improved seeds, improved plant varieties or hybrids, improved hybrids of animals etc.

ii. Knowledge-based technology such as the technical knowledge, management skill and other processes that farmers need to successfully grow crops or produce animal products (Susan, 2005). According to Akinbile (2007), the gap between the rich and the poor countries can largely be attributed to difference in technology. The experience of many developing countries, including Nigeria, bears out this Statement. This countries have seriously set to acquire adopt any technology derived from scientific knowledge since the importance of the contributions of science and technology to development has never been in doubt. A symbolic relationship exists between science and technology. Science is a systematic search for truth provides the bases for technology. Without technology science becomes sterile, and without science technology does not exist. But it is technology, the application of technique and not science which leads to increase in productivity.

According to Ajibefun (2006), technology is the systematic application of scientific or other organized knowledge to practical purposes and includes techniques, methods and materials. According to him, technology as a basis for development is a product of research and can emanate from any knowledge area, be it physical, biological, social and economic. The invention of the incubator which hatches eggs in 21 days is a classical agricultural technology, so is the application of science of generic-linkage to poultry hatchery industry – a biological technology which has revolutionized poultry production making it possible for day old chicks to be separated and hatched into male and female by sex – linked colour differences. Agricultural technologies, includes all the materials techniques practice innovation used to maximize agricultural production. High yielding varieties, mechanization, disease and pest control, fertilizer, pesticides, spacing, leeching, storming, and preservation are concluded (Mgbada, 2010).

Agricultural technologies is referred to as application of principles of technology to agricultural production processes. (Mgbada, 2002) It is the

application of technology (ways of doing things) to control cauterization, growth harvesting of crops, and production of animals for food purposes. Rogers (2003) defined agricultural technology as the application of scientific knowledge or other organized knowledge methods of planting, nurturing, harvesting and processing of crops and animal. It is actually the application of technology that leads to promotion and development of agriculture. These include:

1. New breeds of crops and livestocks.
2. Use of farm chemicals such as fertilizers for disease and pest control.
3. Better ways of land preparation, cultivation, planting, social management of agricultural enterprises for optimum profit.
4. Improved cultural practices such as spacing optimum plant population region, weeding, storage, processing and preservation techniques marketing, price movement, labour and other matters that relate directly to the farmers.

2.6.1 Technological Change and Agricultural Development

Onyeze (2011), quoting Onyemade (2003) observed that technological change or improvement occurs when there is a progressive movement from lower, less efficient ones. That is the process whereby new and better technological changes impact positively on the micro-economy of farmers. It also goes beyond the sectorial and macro-economy level depending on the scale and pace of the change. At the micro-level, technological change manifests in small-holder adoption of transmitted technologies, thereby leading to increased physical and valued productivity of farm resources, which is the development of a new higher production function.

Marrique *et al* (2007), in their paper on the role of Agriculture in Economic Development markets, dug into the technological progress from the sectoral point of view, opined that technological progress can positively alter the structure of agricultural production and stimulate more agricultural growth based on the comparative advantage associated with it. Obviously, in the absence of technological change on improvements, there is technological stagnation and worse still technological regress. Both of them portend deleterious consequences on

resource use efficiency, agricultural productivity, economic growth and development. Furthermore, the small-holders farmer's technological profile can be said to be improving, stagnating or regressing in the context of the interrelated factor that derive from the economic environment. Farmers, especially women can and do react to changing enabling incentives if they do not implement technological change. It is not so much due to their being tradition bound or resistant to change or inherently risk adverse, but rather because of the challenges they encounter (DFRRI, 1986), the National Directorate of Employment (NDE) 1986. The Nigeria Agricultural Insurance Scheme NAIS (1987), the National FADAMA Development Project NFDP 1992, the Poverty Alleviation Programme (PAP) 2000, National Economic Empowerment and Development Strategy NEEDS 2004 and the National Special Programme for Food Scarcity (NSFFS, 2003).

The Federal Government of Nigeria also established programmes which focused on the empowerment of women involved in agricultural production. These programmes included the Better life for Rural Women (1986), Women in Agriculture (1991), Family Support Programme (1994), and Family Economic Advancement Programme (1999) (Adisa and Okunade, 2005). Some of these programmes were replicated at State and Local Government levels and some State Governments had their independent agricultural development programmes. This brief history shows the continuous search for self sufficiency in food production by the Federal Government of Nigeria.

2.7 Agricultural Communication and Information System

Extension services are essentially communicative (Nwachukwu, 2008). The ultimate aim of an extension system is to effectively and efficiently a comprehensive and utilizable manner. Extension service bears great potentials for improving the productivity of natural resources and promoting the right attitudes among natural resources manager (Echetama, 2011). There are problems in communication between the key players in agricultural production. The researchers do not always know the real problems and constraints that farmers face and farmers are often not aware of what scientists have to offer them. Scientists get frustrated

that their research results are not applied, while farmers and the general public become equivocal about the relevance and value of Agricultural research. Nweke (2004) sees communication as a conscious attempt to share information and ideas with others, while Nwachukwu (2008) defined communication as a process by which two or more people exchange ideas facts, feelings, expressions, in ways that each gains a clear understanding of the meaning, intent and use of the message. According to him, successful communication in extension requires a skilled communicator sending a useful message through a proper channel, effectively treated to an appropriate audience that responds as desired.

The key elements identified in his model are (1) communicator (2) message or content (3) channel of communication (4) treatment of message (5) the audience (6) audience feedback as in fig 2.4

Source transmitter – message – destination – feedback

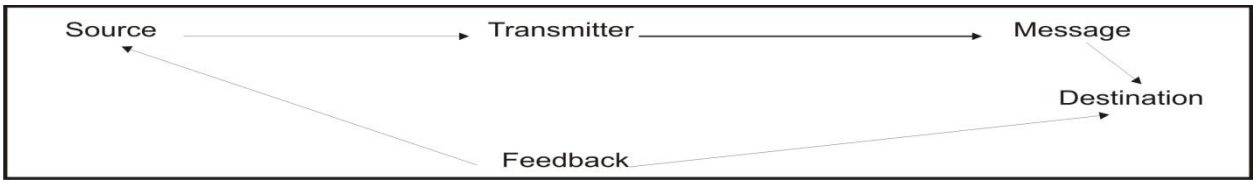


Figure 4: A Simple Communication Model

Information, system according to Roling and Engel (1990), Asiabaka (2002), Ramirez and Quarry (2004) is a system in which agricultural information is generated, transferred, consolidated, received and feedback in such away that these processes function synergically to underpin utilization by agricultural producers. In the concept of information system, the institution generating and receiving information are emphasized, as well as the information flows and linkage mechanisms between them.

According to Nwachukwu and Kanu (2011) information system usually refers to a computer-based system, one that is designed to support the operations, management and decision functions of an organization. Information system in organization provides information support for decision makers. Information system encompasses transaction process system. These authors went further to State that

information consists of data that have been processed and are meaningful to the user. A system is a set of components that operate together to achieve a common purpose. Thus, a management information system collects, transmits, processes and stores data in an organization's resources, programme and accomplishments. The system makes possible the conversion of data into management information for use by decision makers within the organization. A management information system, therefore, produces information that supports the management functions of an organization.

Information system, according to Obayelu and Ogunlade (2006), is a process which improves forms and gives meaning to data. A data system is an attempt to represent reality empirically. These authors stated that information system in agriculture as designed to help public and/or private decision makers make decision to solve problems that arise at the farm, firm, industry or national economy level. They identified three major components that should make up our information system. These include a data system, the analytical capacity necessary to transform data to information and the decision maker. This is depicted diagrammatically.

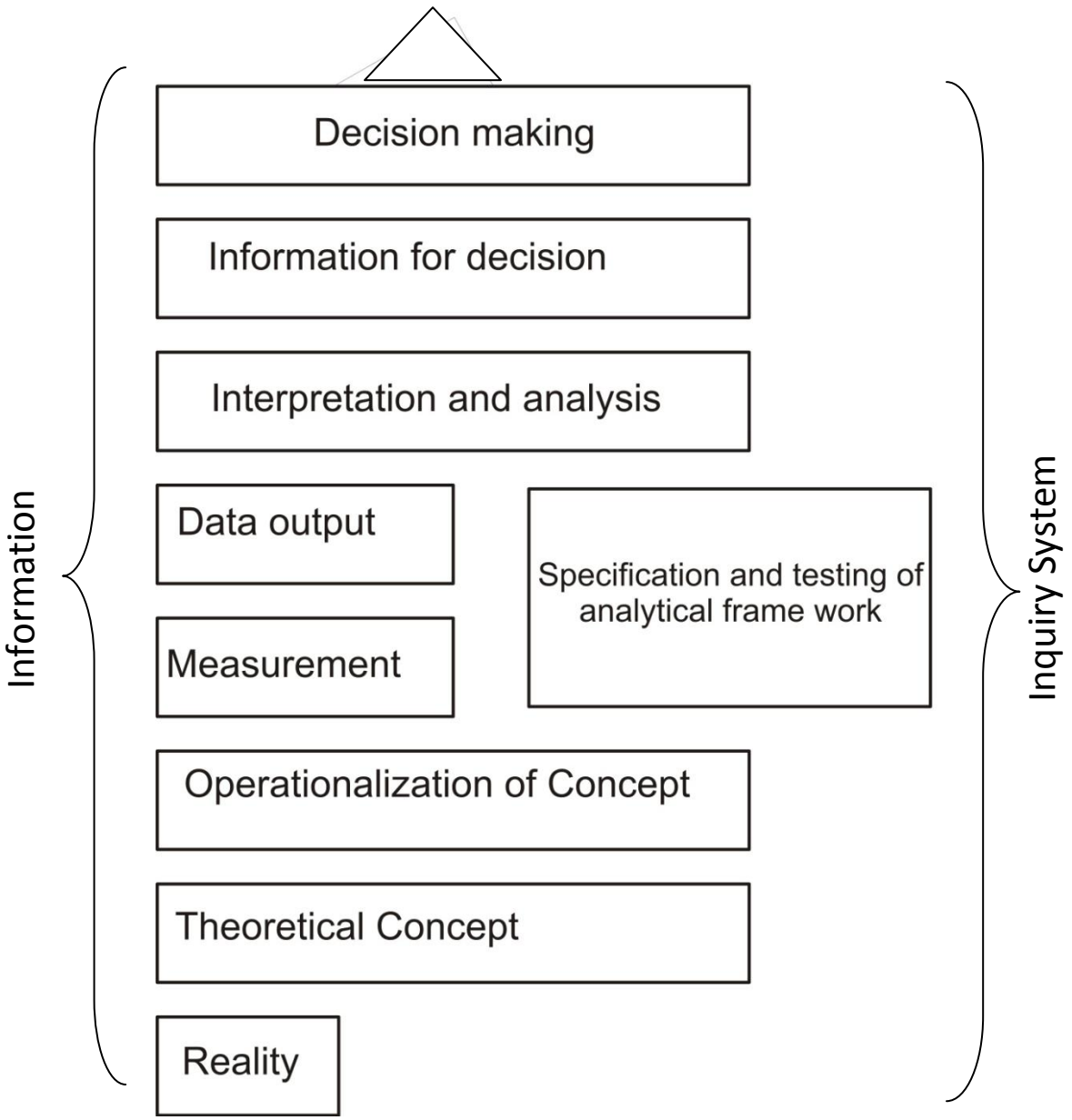


Figure 5: Agricultural Information System Model

The representation shows that a common shared base of theoretical concept of operationalization of concept will involve measurement of data so that information is available in a clear term to the decision makers. Without this common conceptual ground, any attempt to use theory and empirical data in the same analysis would not be fruitful and the fit between the deductive and inductive process of inquiry could not exist.

2.7.1 Mass Media in Agricultural Information Dissemination Function

Farmers need to be informed and educated about improved agricultural practices to enable them increase their productivity and income. Several channels such as extension agents, individual contacts, farmer to farmer contact, print media (newspapers, magazines, newsletters, leaflets, pamphlets and posters) and electronic media (radio, television, film, slides and film trips) have been widely used to disseminate information to farmers (Olowu and Oyedokun, 2008). The required amount of information and learning is, however, so vast that only effective use of multipliers, the mass media (Newspapers, magazine, newsletters, leaflets, pamphlets, posters, radio and television) can provide information at the rate driven by pressure of time, population, geographical constraints and shortage of trained extension personnel in developing countries.

Egbule and Njoku (2008) identified major media systems that have to contribute to agricultural development to include radio, television and print media. They noted that mass media are increasingly becoming a veritable, instrument for transforming Nigerian agriculture, noting that people will derive pleasure form learning how food they eat daily is produced and that they may be encouraged to develop an interest in growing something themselves. Pur and Guary (2008) acknowledged that rapid advancement in electronics and communication technology has opened up new and more effective channels for agricultural information dissemination. They argued that diversity and large number of possible applications of news have formed the emergence of global trade and communication network; a boom in online trade and convergence of telephone, radio, television and internet for farming communities in the developing world, including Nigeria, Radio and Television when used effectively has the potential to bring about rural transformation. Nwachukwu (2008) noted that the relationship between mass communication and food production does not seem immediately obvious. Mass communication conjures up the mass media:- Radio, television, newspaper, magazines etc. Possession of radio set, access to television set, newspapers etc are seen as positive indicators of development. It is the process of making the farmer see, experience, learn, try and adopt the new and improved

techniques used in research farms which are not available to or not properly applied by ordinary farmer.

Ajah (2009) reported that mass media have been found to be the most common source of first hearing about all new practices and most farmers utilize multiple sources of information in the acceptance or rejection on new technologies. Asiabaka (2002) remarked that the use of mass media in community information has limited effectiveness with low income farm population and that they are important in the knowledge stage of the decision making process but are not as useful in late stages. Face-to-face contact are not very efficient for the change agent who will not be able to make large number of personal contacts but these are the most effective means of increasing the adoption of new ideas and practice. Moyi (2009) noted that the task of extension education is accomplished by different extension methods/media, which may come under individual, group and mass contact. The mass contact, which includes both the electronic and print media, is potentially expected to play an important role in technology transfer. The electronic media had a central role in facilitating the exposure of farmers to a variety of information.

2.8 Empirical Review

Under this sub-heading, several empirical works that were carried out by different authors form different places was reviewed. Akinola *et al* (2011) in their study on determinants of adoption of balanced nutrient management systems technologies in the Northern Guinea Savanna of Nigeria. The project on balanced nutrient management systems (BNMS) has been implemented in the northern Guinea savanna (NGS) of Nigeria since 2000 in order to address soil fertility decline. The project has tested and promoted two major technology packages; a combined application of inorganic fertilizer and manure (BNMS-manure) and soybean/maize rotation practice BNMS-rotation). The study used a multinominallogist model to examine factors that influence the adoption of BNMS technologies. The result indicated that factors such as farmer's perception of the State of land degradation, and extension services were found significant in

determining farmer's adoption decision. As farmers got more perception of the State of their degradation and depletion, the rate of BNMS-manure increased by more than five times, while that of BNMS-rotation was quadruple. In another study by Asiabaka and Michelle (2002) on determinants of adoptive behavior of rural farmers in Nigeria; the major objective was to assess the effect of information source and the attributes of technology on the adoptive behavior of rural farmers in Nigeria. It assessed the perception of rural farmers on the availability, credibility and degree of use of information source. The variable tested in technology attributes were complexity, availability and cost and compatibility. Data were collected from 480 farmers from southern eastern Nigeria. Findings indicated that farmer's socio-economic characteristics such as age and education influenced their adoption behavior.

Also sources of information were a significant factor in determining farmer's adoption behavior. Variable such as credibility, availability, interest and usefulness of the information source had positive coefficients and were found to be statistically significant at 0.05 level. Findings also show that technology attributes such as complexity, cost and availability and compatibility were positive and statistically significant 0.05 and 0.01 level.

Bonabana - Wabbi (2012) analyzed the socio-economic factors influencing adoption of improved gum Arabic seedlings among farmers in the Sahehan Zone of Borno State. The study analyzed the socio-economic factors influencing adoption of improved gum Arabic seedlings among farmers in the Sahelian zone, Borno State, Nigeria. The data for the study were mainly generated from farming household through the use of structured and pretested interview schedules. Multi-stage, purposive and random sampling techniques were employed to select 321 representatives of farming households that were used for this study. Both descriptive (frequencies, means and percentages) and inferential (logit regression) statistics were used to analyze the data collected for this study. The result shows that most of the respondents had farmer's cooperative as their source of gum Arabic seedlings and analysis shows that socio-economic characteristics had influence on the adoption of improved gum Arabic seedling farmers.

Furthermore, Akinwumi and Jojo (1995) in their study on farmer's perceptions and adoption of new agricultural technology evidence from analysis in Burkina Faso and Guinea, West Africa. This paper tested the hypothesis that farmer's perceptions of technology characteristics significantly affected their adoption decisions. The analysis conducted with Tobit models of modern sorghum and rice varieties technologies in Burkina Faso and Guinea, respectively, strongly supported this hypothesis. The study showed that farmer's perception of technology characteristics significantly affects their adoption decision.

Lawal, Liman, and Lakpene (2014) based their study on adoption of yam minisett technology by farmers in Niger State, Southern Guinea savannah, Nigeria. The study examined the level of awareness, adoption and factors that influence adoption of yam minisett technology package in Niger State. Data for the study were obtained from a field survey of 150 yam farmers using multistage simple random sampling technique. Descriptive statistics and Probit regression model was used to analyze the data. The result of the study shows that a typical yam farmer is about 42 years, literate and about 17 years experience in yam production. The result also revealed that about 69.35% of yam farmers were aware of the yam minisett technology, while only 35% adopted the technology on their farm during the survey. Compliance with recommended production technology also varied among adopters.

Chatura, Allen and Michael (2006) conducted a study that specifically looked at the determination of productivity growth of agricultural cooperatives. The study assessed the production growth and analyzed the extent of the growth in agricultural cooperatives. The study confirmed that rather than increasing area of individual decision making unit, if the decision making units could bring together their resources and go for cooperative farming, the scale efficiency will improve. Generally, they found that agricultural cooperatives encouraged technological improvement and helped improvement in efficiency.

Fulton and Adamowiez (2003) as cited in fulton (1999) explored the factors that influence the commitment of members to their cooperative organization. It was observed that the more the individual member gets as dividend or patronage

refunds, the more committed that member will be. Price is another most obvious determinant of the focus of action as people are expected to choose the organization that has the best price to offer. Using the services with the best price benefits the user financially; the more use, the more profit they see price as having also a mediating role and argue that member commitment is likely to be low when the cooperative is unable to maintain production efficiency. This is because higher costs raise prices regardless of the objective pursued by the cooperative. In other word, there is likely to be a positive relationship between production efficiency and member commitment where price mediates the relationship.

Another set of studies examining agricultural cooperative activities have explained the factors affecting the adoption of various types of cooperative activities (Katehova and Miranda, 2004; Davis and Gillespie 2007) with an overview of contracting studies provided by Mac Donald *et al* (2004) and Ahearn *et al* (2005). These findings present interesting insights into the organizational form of contractors and contract price comparison. Farmers frequently contract with cooperatives, with about one to three quarters of all contracts being owned firms. The fact that prices received on contracts do not seem to be different based on the type of contractor provides indirect evidence of a cooperative benefit since the members do not have price penalties in contracting with cooperatives, but retain the upside potential of a patronage payment. From the foregoing, there is no doubt that cooperative membership enhances adoption behavior of cooperative farmers, hence the study.

Gap in Literature.

Amahalu (2010) identifies the motives for establishing or joining cooperatives as economic benefits and sociological benefit. The work of Onyeze (2010) showed that cooperatives, among other measures, can wage war against, poverty like unemployment, insufficient food supply, inadequate shelter, clothing for the common man. According to Ghosh and Maharjan (2001), Larocque, Kalala and Gaboury (2002), Adedayo and Yusuf (2004) examined the effect of cooperative on members' standard of living. However, Pullet (2008) noted that the role of cooperative societies on members' standard of living and poverty reduction

has not been studied in any systematic way. Ajayi *et al* (2003) found that women farmers had low knowledge and skills in performing the following farm operations, chemical application, weeding and pest control, preparation and utilization of organic fertilizer, livestock and poultry breed selection and construction of livestock houses.

Adesoji *et al* (2006) examined the isolated determinants of training needs of FADAMA farmers in Ogun State of Nigeria, as socio-economic, informational, credit, land resources, cultural and training related factors. Ajayi *et al* (2003) found out that various vegetable grown by the farmers in FADAMA in Bama Local Government Area of Borno State showed that Onion was the most popular vegetable followed by carrot and tomatoes.

Ogunjimi and Adekalu (2002) carried out a study on FADAMA and discovered that FADAMA practices has increased significantly over the last 10 years because of demand and high cost of vegetables produced by farmers.

2.9 Theoretical Framework

This study is anchored on resource-based theory, the diffusion theory and collective action. **The Resource-Based Theory**

The resource-based view (RBV) emphasizes the firm's resources as the fundamental determinants of competitive advantage and performance. It adopts two assumptions in analyzing sources of competitive advantage (Barney, 1991). First, this model assumes that firms within an industry (or within a strategic group) may be heterogeneous with respect to the bundle of resources that they control. Second, it assumes that resource heterogeneity may persist over time because the resources used to implement firms' strategies are not perfectly mobile across firms (i.e., some of the resources cannot be traded in factor markets and are difficult to accumulate and imitate). Resource heterogeneity (or uniqueness) is considered a necessary condition for a resource bundle to contribute to a competitive advantage.

The theory is predominantly used to analyze strategic resources that are available to firms. Resources include all assets, capabilities, organizational processes, firm attributes, information and knowledge that are controlled by firms

and which enable them to conceive of, and implement strategies that improve efficiency and effectiveness (Barney 1991). Resources are either property-based or knowledge-based (Wiklund and Shepherd 2003). In this respect, property-based resources are tradable and non-specific to the firm, while knowledge-based resources are the ways in which firms combine and transform tangible input resources. Therefore, knowledge-based resources may be important in providing sustainable competitive advantage (Barney, 1991). Age and education are two common sources of knowledge-based resources, which influence access to bank credit (Kimuyu and Omiti, 2000; Zeller, 2000). Other sources of knowledge-based resources that have the potential to influence access to bank credit include business history, entrepreneurial experience, industry specific know-how, training and social capital, cooperative membership, credit history, size of business. From the supplier firm point of view, some resources are also necessary for becoming competitive. In this case, the lending institutions need quantum of credit to lend from, trained staff, effective logistics, flowchart of convenience services and stronger outreach in order to satisfy their customer's need competitively.

The above-mentioned characteristics are individually necessary, but not sufficient conditions for attaining superior outcomes. The organization of these resources is very important (Barney, 1991). The organizing activities here include cognitive aspects such as planning, decision making or failure considerations and actions such as resource acquisition.

The fundamental principle of the resource-based theory is that the basis for a competitive advantage of a firm lies primarily in the application of the bundle of valuable resources at the firm's disposal. This requires resources to be heterogeneous in nature and not perfectly mobile (Barney, 1991). It also means that valuable resources should neither be perfectly imitable nor substitutable without great effort. If these conditions hold, the firm's bundle of resources can assist the firm to have unique dispositions that lead to superior outcomes.

The concept of diffusion inherently focuses upon process. Diffusion refers to the dissemination of any physical element, idea, value, social practice, or attitude through and between populations. Diffusion is among the rare concepts used across

the physical, natural, and social sciences, as well as in the arts. Diffusion is most closely associated with the social sciences, particularly rural sociology, anthropology, and communication.

There are at least three traditions or theory families that can be historically discerned in the study of diffusion. The three theory families are**:**

1. Cultural diffusion
2. Diffusion of innovations; and
3. Collective behavior

For the purpose of this study, diffusion of innovation is most appropriate to know why people change from one attitude to the other; ie. Change from local agricultural tools to high technical tools or to improved varieties of crops that has high resistance capacity.

Diffusion of innovation (DOI) theory, developed by E.M. Rogers in 2003, in one of the oldest social science theories. It originated in communication to explain how, over time, an idea or product gains momentum and diffusion (or spreads) through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior or product. Adoption means that a person does something differently than what they had previously (i.e., purchase or use a new product, acquire and perform a new behavior, etc). The key to adoption is that the person must perceive the idea, behavior, or product as new or innovative. It is through this that diffusion is possible.

Onu (2003) opined that participation in various farmer social organization is generally considered an important variable that enhances farmers' adoption of new practices. Nigeria farmers who participate actively in the life of their communities, membership in, and leadership of social organizations, social clubs, age grades, village council and contact farmer ship etc are more likely to be exposed to communication message that are related to farm innovations and adoption more than their other counterparts due to group dynamic effects. Cooperative being socio-economic association which acts collectively to achieve a set objective which could not be achieved individually. New innovation could be easily transferred to the

cooperative farmers as a group. Hence, cooperative farmers are expected to adopt new agricultural technologies (innovations) promptly than non-cooperative members.

Theory of collective action are built to understand how group of individuals are able to cooperate to overcome social dilemmas, assuming that being a self-interested, short term maximize is the default (Bray, 2008). The theory of collective action has of recent attracted favourable comments in development discussions. This is due to the changing paradigm on establishment of community and rural projects that now emphasized the role of beneficiaries as important variable that determine success.

Marshall (1988) defines collective action as an action taken by a group (either directly or on its behalf through and organization) in pursuit of member's perceived shared interests. Other definitions include those suggested by at CAPRI workshops: For example, it is seen as joint action for the same goal and actions to achieve a common objective, when the outcomes depend on interdependence of members. Essentials of collective action require: involvement of a group of people, a shared interest within the group and involvement of some kind of common action which works in pursuit of that shared interest. Although not often mentioned, this action should be voluntary in order to distinguish collective action from hired group or curve labour. Examples of collective action include collective decision-making, setting rules of conduct of a group and designing management rules, implementing decisions, and monitoring adherence to rules. Members can contribute in various ways to achieve the shared goal: money, labour or in kind contributions (food. wood).

The action can take place directly by members of a group, or on their behalf by a representative or even employee. The coordination can take place through a formal organization through an informal organization, or, in some cases, through spontaneous action. Thus, an organization may contribute to collective action, but the two concepts are not the same. In the context of natural resource management, the collective action of deciding on and observing rules for use or non-use of a

resource can take place through common property regimes or by coordinating activities across individual farms.

Collective action is easiest to identify when there is a clearly defined group that takes part. Moreover, clearly defined boundaries is the first of Ostrom's (1992) design principles for long-enduring, self-organized irrigation systems, which have also been applied to many other cases of natural resource management. This indicates that boundedness of the group, which allows people to know who else is (or should be), contributing, fosters collective actions. At the same time, in many instance of collective action, it is not clearly how the group is defined nor is the boundaries necessarily fixed or rigid. Some people may participate on time, others another, with none of them knowing exactly who is involved, but all identifying with the collective action. For example, neighborhood clean-up activities may be done periodically without clearly defining who is in the neighborhood. Thus, there is a gray area between organized and bounded collective action and action within more amorphous social network, although formally organized collective action is preferred.

Formal or informal organizations may be helpful in coordinating collective action, but it is important to distinguish between organizations and collective action. Many organizations exist on paper only, and do not lead to action; conversely, collective action may occur spontaneously. Moreover collective action can manifest itself and can be understood as an event (a one time occurrence), as an institution (rule of the game applied over and over again), or as a process. While many previous studies analyzed the institution of collective action, others like Sultana and Thompson (2003) focused on the process of collective action. The event, for example collective response to a flood versus institution (collective maintenance of an irrigation system) presents by itself a very interesting question: when does an occurrence become institutionalized and what are the implications? Institutionalization depends on the object of collective action; any kind of collective action for routine maintenance will likely become institutionalized because it is a recurrent need in a community or group of users, while collective action for seed

exchanges is likely not to be institutionalized where the need to exchange seed occurs only sporadically (Badstue *et al*, (2002). On the other hand, institutionalization reduces transaction costs of renegotiation, as well as uncertainty, but on the other hand, the more institutionalized collective action, the less flexible and adaptable it becomes.

2.9.1 Different Types of Collective Action

In the literature, collective action has been described as taking various forms, including the development of institutions, resource mobilization, coordination activities and information sharing (Poteete and Ostrom, 2003). The purpose of collective action affects the level at which we have to analyze the phenomenon: which institutional level (operational, collective choice or constitutional level if we use Oakerson's (1992) institutional framework and which social unit (individual, national) Federations of forest and water user groups in Nepal provide examples of larger-scale collective action. The appropriate units of analysis will, therefore, vary depending on the research or policy question (Place and Swallow, 2002).

Complexity of collective action relationship has been long recognized. There are three important contributors to this complexity: the high number of variables affecting collective action, the feedback relationships, among many variables of interest (Agrawal, 2001), and the adaptive nature of both collective action and object. For example, the State of, and management over, many natural resources (Wilson, 2002). Here we will focus only on a few of these aspects.

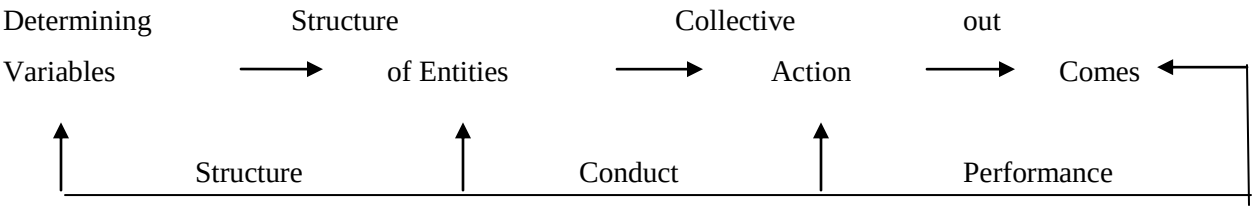
Procedures in Collective Action

Clearly defining concepts, outcomes, decisions, actions, inputs, proxy variables, and the process of implementing collective action is the key to undertaking sound research on collective action. Definitions within each of these categories are not always clear, especially where social capital is taken to be a determining variable. Here, the structure, conduct, and performance framework, first group, community, intra-community etc. Similarly, indicators of collective action might differ depending on the specific objective of collective action. If we

investigate collective action for the constitution action for the maintenance of an irrigation system or collective action for the constitution of a federation of watershed groups, indicators of collective action will again differ, or in any case not overlap entirely. Poteete and Ostrom's paper (2003) discusses how indicators had to be redefined when moving from the study of irrigation system to forestry, and the tension of maintaining a common core set of measures even more forestry sites around the world.

Clearly, it is also critical to identify the level at which collective action takes place. Many studies focus on community-level collective action, but not all forms of collective action take place at this level. Many micro programs for example use groups of ten to twenty members. McCarthy *et al,* (2002) work, demonstrated the importance of cooperation among groups within the community. For example, for water point management. Sultina and Thompson (2003) studied the process of fostering collective action in multi-stakeholder processes, and introduced by Bain (1959) in industrial organization theory, can be useful in distinguishing these different dimensions, and their interrelationships, as illustrated in Fig. 1. One may consider that a number of factors influence the structure of groups, organizations or other entities, which in turn influence the conduct of the groups, especially with regard to collective action (a process). Yet, neither the organizations nor the collective action itself are the ultimate objective: performance outcomes are important as well. Even this is not the end of the story, because feedback loops and co-movement of variables are likely to be important in a dynamic setting, indicating endogenous relationships among of the variables of interest, indicated by the dashed lines in Fig. 1. Both qualitative and quantitative studies must take these interactions into account, and determine which variables can be safely taken as given. In any one time period, and which variables are truly exogenous variables.

Figure 6: Schematic representation of structure, conduct, and performance of collective action.



Source: Bain (1959)

Relevance of Collective Action Theory to the Study of the Role of Farmers Multipurpose Cooperative Society in Rural Development

Collective action can provide significant benefits in reducing negative externalities in Community-based or programme that demand active participation of beneficiaries. Where collective action has a strong basis in community norms, members are more likely to abide by access and management rules. Where, when enforcement comes from the group, monitors and other officials are more accountable and the cost of adjudication is often lower than in State-based programs. These benefits frequently translate into greater effectiveness of natural resource management or other local development programs. They can also have a positive impact on poverty and gender inequities, especially of collective action results in more equitable distribution of resources that can improve livelihoods for marginalized groups. In addition to improved resource distribution, collective action can also serve as a way for the poor to pool risks so that they can realize bigger benefits through long-term planning.

Undoubtedly cooperative action that is aimed at benefitting members is clearly covered by and at the heart of collective action. Thus, an understanding of why people join cooperative and why they work tirelessly for its sustenance and progress for the benefit of not only the members but also for the good of the wider society.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

Research design is a term used to describe a number of decisions which need to be taken regarding the collection of data before data are collected. Design in research is broadly viewed as steps a researcher should to take in carrying out his research project. For the purpose of this study, survey and descriptive research design were employed. Survey research design was chosen because it is relatively low cost considering the fact that useful information is collected about a larger number of people from a relatively small number (representative sample) it is easy to generalize the findings to large population once representativeness of the sample is assured.

3.2 Area of Study

The study area for the research, Enugu State was created in 1991.

Enugu State is situated within the highlands of Awgu, Udi and Nsukka hills and the rolling lowlands of Ebonyi River Basin in the west (ENADEP Report 2008) The State is bounded in the south by Abia State, Ebonyi State to the East, Benue State to the North West and Anambra to the West. It has entirely within the tropical zone, precisely between latitude 06°.00 and 07°.50N and longitude 06°.52 and 08°. 30E (ENADEP Report, 2008).

The State has an estimated land area of 12727 square kilometers with an estimate population of about 4332,275 persons (Enugu State Blue Print on Agricultural Policy and programme 2006). As it extends north ward, the terrain slowly changes from tropical rain forest to open woodland to savannah. The majority of the area comprises low-lying that is covered with a network of streams and rivers, costal landscapes and highland.

Enugu State is made of seventeen (17) Local Government Areas namely; Enugu North, Enugu South, Udi, Ezeagu, Nkanu East, Nkanu West, Isi-uzo, Uzo-Uwani, Igbo-eze North, Igbo-eze south Nsukka, Udenu and others. The State is also sub-grouped into zones both for political and agricultural administrative purposes.

These are Enugu East, Enugu west and Enugu North. The settlement structure is still rural with over seventy percent (70%) of the people living in rural areas (ENSGN, 2007). The people are predominantly farmers as an average family engaged in the production of food crops like yam, cassava, cocoyam, rice and maize, and livestock like sheep, goat, rabbit, poultry and pig. Cash crops cultivated include palm produce etc. The State is culturally homogenous predominantly, inhabited by the Ibo ethnic group of Nigeria were Igbo language is spoken with minimal differences in dialects. The people are predominantly Christian and English language is the official language.

3.3 Population of the Study.

Population of the study is made up of all rice farmers cooperative societies in Enugu State that participated in FADAMA project. Enugu State is made up of three agricultural zones namely Enugu East, Enugu West and Enugu North. All the local governments that are involved in FADAMA rice production were used for the study. According to State Department of Cooperative, there are 323 registered cooperative societies that participated in FADAMA programme, out of which 48 were into rice farming. These 48 FADAMA rice farmers cooperative with membership strength of 964 constituted the population of the study.

3.4 Sample Size Determination and Sampling Procedure

The selection of the sample for the study involved multi-stage random sampling technique which involved three stages. The first Stage involves a purposive selection of two LGAs that are predominantly rural and agrarian from each of the three agricultural zones in Enugu State. Second stage involved random selection of cooperatives in the selected Local Government Area that participated in FADAMA programme.. The third stage involved selecting the cooperative societies that were into rice farming. Therefore, a total of 331 members were selected from 24 rice farmers cooperatives who participated in FADAMA programme as sample size.

Table 3.1 Population of Cooperatives in the area of study and selection of sample

Agricultural Zone	No. of functional cooperative	No. of cooperatives in FADAMA	No of Cooperative into rice farming	Membership Strength
Enugu East				
Nkanu East	76	21	5	71
Nkanu West	81	24	4	62
Enugu West				
Ani Nri	61	17	3	46
Oji Riverl	49	14	4	52
Enugu North				
Ezeagu	52	20	5	59
Uzo Uwani	45	17	3	41
Total	**364**	**113**	**24**	**331**

3.5 Instrument for Data Collection

The instrument used for data collection is a structured questionnaire designed by the researcher, in line with the objectives of the study. Information obtained were with respect to socio-economic characteristics of the farmers such as age, gender, education, farm size, household size, location, membership of cooperative and farm experience. Other information obtained included their relationship and involvement with cooperatives.

Section B of the questionnaire focussed on level of adoption of improved technology, factors that influence adoption, contributions of cooperative to adoption and hindrances to adoption. A five-point rating scale was employed to capture the extent of agreement and disagreement. Out of the 331 copies of questionnaire distributed, 320 were returned. The respondents were requested to express their opinion by ticking (√) on a five-point Likert scale as shown.

SA- Strongly Agree 5 points

A- Agree 4 points

U-	Undecided	3 points
D-	Disagree	2 points
SD -	Strongly Disagree	1 point

The levels of agreement or disagreement (High/low) on questions asked were compared to the mean rating threshold of 3.0. Any item in the instrument which has a mean equal to or higher than 3.0 was regarded as agree/high, while any item with less than 3.0 was regarded as disagree/low.

3.6 Validity of the Research Instrument

In order to validate the face value and content quality of the research instrument, the draft of the questionnaire was issued to validators, including the research Supervisor, and lecturers in the field of study who critically examined the extent to which the instrument could capture the extent of adoption including the determining factors. They were provided with the objectives of the study, research questions and hypothesis. This was important to ensure the items actually generated the information required.

3.7 Reliability of the Research Instrument

The test-retest technique was used to ensure reliability of the instrument. To determine this, a total of 22 rice farmers in Ani-nri Local government Area were selected and administered with the questionnaire twice at an interval of 14 days. The correlation of the two sets of scores was computed using the Pearson Product Moment Correlation as 0.841. The high coefficient indicated good consistency of the questionnaire.

Table 3.2 Reliability of the Research Instrument

		First session	Second session
First session	Pearson Correlation	1	.841**
	Sig. (2-tailed)		.000
	N	22	22
Second session	Pearson Correlation	.841**	1
	Sig. (2-tailed)	.000	
	N	22	22

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

3.8 Method of Data Analysis

Both Descriptive and inferential statistics were employed in achieving the objectives of the study. Frequency distribution, percentages and mean score rating were used to achieve objectives one, three and four. A mean score of 3.00 and above was considered significant while less than 3.00 were considered not significant. Hypotheses one, two and four were tested using sample test, one-way ANOVA and sample t-test respectively. Hypotheses three was analyzed using regression equation, while t-statistics and F-test were used to test whether to accept or reject the hypothesis at 5% level of significance.

MODEL SPECIFICATION

Hypotheses three which measured the effect of cooperative on adoption of improved agricultural technologies was tested using regression equation. The three (3) functional forms used for the analysis which include, linear, semi-log and double log.

1. The linear form is given by

   $Y = f(x_1\, x_2\, x_3\, x_4\, x_5 + \ldots\ldots\ldots\ldots$ ie) implicit

   $Y = b_0 + b_{1x1} + b_{2x2} + b_{3x3} + b_{4x4} + b_{5x5} + \ldots\ldots\ldots\ldots\ldots$ ei) explicit
2. The semi-log form

   $Y = b_0 + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 \ldots\ldots\ldots\ldots\ldots$ ei)

3. The double log form

$$\text{Log } y = b_0 x b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 \ldots\ldots\ldots + ei$$

Y level of adoption of technologies measured by number of technologies adopted by the farmers cooperative societies.

A = constant

$B_1 = B_n$ = Regression coefficient to be estimated

X_1 – Sex (no)

X_2 – Age (years)

X_3 – Level of education (no of years spent in school)

X_4– Farm size (ha)

X_5 – Annual Farm Income (₦)

X_6– Extension contact (no of visit)

X_7 – duration in cooperative

X8- Volume of output

The model of best fit was the linear model so it was chosen based on statistical and econometric criteria such as the number of significant variables the signs of the number of the regression coefficient as they conform to *apriori* expectations and the magnitude of the coefficient of multiple determinations R^2.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Socio-Economic Characteristics of the cooperatives

In this chapter, data collected were presented and analyzed. Research questions and hypothesis were respectively answered and tested based on the data collected.

Table 4.1 Socio-economic characteristics of the FADAMA Rice farmers studied

No.	Variables	Frequency	Percentage (%)
1.	**Sex of the Respondents**		
	Male	135	42
	Female	185	58
	Total	320	100.00
2.	**Age of the respondents**		
	Less than 25	36	11
	26- 40	84	26
	41-65	148	46
	Above 65	52	16
	Total	320	100.00
3.	**Marital status**		
	Single	70	22
	Married	161	50
	Widowed/divorced	89	28
	Total	320	100.00
4.	**Farm size**		
	Less than I hectare	135	42
	3 hectare	146	46
	Above 3 hectare	39	12
	Total	320	100.00
5.	**Educational qualification**		
	No formal education	25	8
	Primary	123	38
	Secondary	143	45
	Tertiary	29	9
	Total	320	100.00
6	**Household size**		
	1-3	32	10
	4-6	73	23
	7-9	130	41

	10-12	63	19
	Above 12	22	7
	Total	320	100
7	**Years of cooperative membership**		
	0-5 years	74	23
	6-10 years	146	46
	11-15 years	53	17
	16-20 years	40	12
	Above 21 years	7	2
	Total	320	100
8	**Output**		
	Less than 1ton	28	8
	1-3tons	142	44
	4-10tons	130	41
	Above 10tons	20	7
	Total	320	100
9	**Annual income**		
	Less than 500,000	31	10
	500,001 – 1million	120	38
	1m- 3million	146	46
	Above 3million	23	6
	Total	320	100

Table 4.1 revealed the socio-economic profile of the members of rice farmers cooperatives studied. Majority of them were females (58%) and between the ages 41-65. Thirteen seven percent of them were less than forty years, while only sixteen percent were above sixty-five years. A large percentage of the farmers cultivated on between 1-3 hectares of land. Only twelve percent exceeded this threshold, while 42% were smallholder farmers cultivating on less than one hectare of land.

Majority of the respondents were literate with 92% of formal schooling. Interestingly, 54% attempted secondary and tertiary education, whereas only 38% attempted primary education. This implies that the population studied was literate and were able to understand the techniques involved in technology transfer. Table 4.1 showed that majority of the respondents has spent over 5 years as cooperative members (77%). Only 23% were relatively new to cooperative. Others have spent 11-15years (17%). The largest sub-group was those that spent between 6-10 years whereas the least was those that spent above twenty years (2%).

A large percentage of the respondents were married (50%), while 28% of them were widowed/divorced. Twenty-two percent were still single. In terms of household

size, majority had large household. Over 60% of the respondents had household size that was larger than seven persons. Only 10% had small household size of less than four persons. Furthermore, majority of the respondents' annual output was between 1-3 tons. Only 8% produced less than one ton, while 7% produced above 3 tons. In terms of annual income, the largest category earn between 500,000 to 3 million naira annually. Ten percent earn less than 500,000 whereas 6% earn above 3 million annually.

Table 4.2: Extent of adoption of selected improved agricultural technologies among cooperative rice farmers in Enugu State

S/N		**Mean**	**Standard deviation**	**Decision**
1	Spacing	2.90	0.895	Low
2	Varieties	3.53	0.675	High
3	Line planting	4.45	0.785	High
4	Fertilizer application	3.62	0.870	High
5	Lime application	2.23	1.065	Low

Field survey, 2017.

According to Table 4.2**,** the extent of adoption of use of improved varieties, line planting and fertilizer application by cooperative rice farmers in Enugu State was high. The table showed that adoption of spacing and lime application was low in the area. The use of line planting and fertilizer application rank high among the improved agricultural technologies adopted by cooperative rice farmers in the area of study.

Test of hypotheses 1

Ho1: FADAMA cooperative rice farmers in Enugu State have not significantly adopted improved agricultural technologies

Table 4.3. Test of hypothesis One

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Level of adoption	320	3.150	.43667	.05637

One-Sample Test

	Test Value = 0					
					95% Confidence Interval of the Difference	
	T	Df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Level of adoption	22.174	319	.000	3.25000	1.1372	1.3628

According to the one sample test table, level of adoption of improved agricultural technologies was significant at 0.05 level of significance with t-value of 22.174. Therefore the null hypothesis was rejected, and it was concluded that cooperative rice farmers in Enugu State have significantly adopted improved agricultural technologies.

Objective 2

Table 4.4: Mean rating of factors that influence adoption of improved agricultural technologies

	Frequency	**Mean**	**SD**	**Remark**
Sex	320	2.8	1.652	Reject
Education	320	3.8	1.873	Accept
Farm size	320	3.9	2.109	Accept
Annual income	320	4.4	1.094	Accept
Age	320	2.9	0.425	Reject
Contact frequency with extension agents	320	4.7	2.092	Accept
Cooperative membership	320	4.6	1.983	Accept
Location	320	2.1	2.209	Reject
Farming experience	320	3.7	1.983	Accept
Motive for farming	320	3.3	1.915	Accept
Parents occupation	320	2.2	2.107	Reject
Source of information	320	4.1	2.625	Accept
Status in farmers association	320	1.6	1.328	Reject
Training attendance	320	4.1	2.872	Accept
Source of fund for farming	320	1.9	3.815	Reject
Value of productive assets	320	2.8	0.218	Reject
Availability of success stories	320	4.3	2.761	Accept
Attitude of extension agents	320	4.4	2.902	Accept
Type of farming technology	320	2.4	3.981	Reject
Literacy level of farmers	320	3.8	2.671	Accept

Table 4 revealed that factors that influence adoption of improved agricultural technologies include: education level, farm size, annual income, frequency of contact with extension agents, cooperative membership. Others were motive for farming, number of training attended, availability of success stories, source of the information and attitude of extension agents. Surprisingly, factors such as age, sex, location, occupation of parents, status in farmers association, source of fund for farming, value of productive assets and type of farming technology in use did not have appreciable influence on adoption of agricultural technologies.

Ho4: Inadequate extension services, cost of adoption, market value of rice, and illiteracy are not significant hindrances to adoption of improved agricultural technologies among FADAMA rice farmers in Enugu State.

Test of hypotheses 2

Ho2: Farmer specific and institutional factors do not have significant influence on adoption level of agricultural technologies among FADAMA rice farmers in Enugu State.

Table 4. 5 ANOVA table (One way) showing factors that influence adoption of agricultural technologies

		Sum of Squares	df	Mean Square	F	Sig.
Sex	Between Groups	1.752	5	.350	1.436	.209
	Within Groups	144.873	315	.244		
	Total	146.625	320			
Education	Between Groups	35.108	5	7.022	1.088	.366
	Within Groups	3832.611	315	6.452		
	Total	3867.718	320			
Farm Size	Between Groups	44.960	5	8.992	7.699	.210
	Within Groups	693.734	315	1.168		
	Total	738.693	320			
Frequency of contact	Between Groups	7.382	5	1.476	3.082	.009
	Within Groups	284.511	315	.479		
	Total	291.893	320			
Age of respondents	Between Groups	15.624	5	3.125	4.257	.031
	Within Groups	436.001	315	.734		
	Total	451.625	320			
Membership of cooperative	Between Groups	28.195	5	5.639	8.985	.000
	Within Groups	372.803	315	.628		
	Total	400.998	320			
Location of the farm	Between Groups	13.888	5	2.778	1.254	.282
	Within Groups	1315.710	315	2.215		
	Total	1329.598	599			
Farm experience	Between Groups	16.030	5	3.206	1.569	.027
	Within Groups	1213.803	594	2.043		
	Total	1229.833	599			
Type of technology in use	Between Groups	195.541	5	39.108	25.490	.100
	Within Groups	911.332	594	1.534		
	Total	1106.873	599			
Motive for farming	Between Groups	1.398	5	.280	1.229	.094
	Within Groups	135.076	594	.227		
	Total	136.473	599			
Parents occupation	Between Groups	4.035	5	.807	2.385	.037
	Within Groups	200.950	594	.338		
	Total	204.985	599			
Source of information	Between Groups	11.944	5	2.389	2.111	.033
	Within Groups	672.254	594	1.132		
	Total	684.198	599			
Status in farmers association	Between Groups	5.548	5	1.110	1.368	.234
	Within Groups	481.645	594	.811		

	Total	487.193	599			
Annual income	Between Groups	28.710	5	5.742	3.133	.008
	Within Groups	1088.783	594	1.833		
	Total	1117.493	599			
Training attendance	Between Groups	18.366	5	3.673	2.171	.046
	Within Groups	1004.967	594	1.692		
	Total	1023.333	599			
Source of fund for farming	Between Groups	5.920	5	1.184	1.143	.336
	Within Groups	615.273	594	1.036		
	Total	621.193	599			
Value of productive assets	Between Groups	13.003	5	2.601	4.653	.000
	Within Groups	331.956	594	.559		
	Total	344.958	599			
Success stories	Between Groups	7.330	5	1.466	3.689	.003
	Within Groups	236.055	594	.397		
	Total	243.385	599			
Attitude of extension agents	Between Groups	21.271	5	4.254	2.317	.012
	Within Groups	1090.794	594	1.836		
	Total	1112.065	599			
Literacy level of farmers	Between Groups	13.646	5	2.729	3.758	.002
	Within Groups	431.419	594	.726		
	Total	445.065	599			

In Table 4.5, the resulted test of hypothesis 2 was presented. Out of the twenty factors presented, only 12 were significant. These twelve factors include education level, farm size, frequency of contact with extension agents, cooperative membership, farming experience, motive for farming, annual income, number of training attended, availability of success stories, literacy level of farmers and attitude of extension agents. These factors have high f-ratio and significant at 0.05 level of significance. As a result, the null hypothesis is rejected. So we conclude that farmers' specific and institutional factors influence adoption of agricultural technologies.

Table 4.6. Contributions of cooperative to adoption of improved agricultural technologies

	Frequency	Mean(X)	SD	Remark
Awareness creation	320	4.2	2.908	Accept
Sharing of ideas	320	2.7	2.871	Reject
Mitigating hindrances /objections	320	3.9	1.093	Accept
Provision of guarantee	320	3.4	3.983	Accept
Bargaining for cheaper cost of adoption	320	4.1	2.351	Accept
Convincing laggards and late adopters	320	4.7	3.981	Accept
Peer pressure towards adoption	320	4.1	0.378	Accept
Cheaper platform to achieve mechanization/modernization	320	4.4	4.936	Accept
Access to reliable experts	320	2.7	2.187	Reject
Provision of accessible experiment/practical	320	1.8	3.916	Reject
Platform for accessing adoption support services	320	4.2	2.871	Accept
Access to government /donor aids and assistance	320	3.9	3.157	Accept

Table 4.6 revealed that agricultural cooperatives contribute to awareness creation, mitigating objections to adoption, providing guarantee and cheaper platform to access adoption service. Respondents also agreed that cooperatives provides access to government aids and assistance, as well as convince laggards on the need to adopt new technologies. However, majority of the respondents insisted that agricultural cooperatives do not contribute in sharing adoption ideas nor provide access to reliable experts and accessible experiment.

Test of hypotheses 3

Ho3: Cooperatives do not have significant effect on adoption level of agricultural technologies among FADAMA rice farmers in Enugu State

Table 4.7 Regression Estimates (Effects of cooperatives on adoption of improved technologies)

Model	**Coefficient Estimates**	**t-Value**	**Significance**
(CONSTANT)	1.187	5.023	0.030
Sex	0.184	1.904	0.273
Marital	0.206	1.860	0.428
Education	2.016	4.121	0.039
Housize	3.099	3.763	0.178
Farmexp	1.713	4.871	0.016
Coopdura	2.205	6.194	0.026
Age	0.421	1.437	0.076
Annual income	3.190	1.87	0.023
Output volume	0.425	1.246	0.149
Contact frequency	2.670	3.761	0.029
R^2	0.782		
Adj R^2	0.767		
F	22.774 (Sig. @ 0.05)		

Dependent Variable: Annual Rural farm income

The estimates of coefficient of multiple determinations (R^2) and Adj. R^2 suggest that all the variables in the model collectively accounted for more than 78% of the variations farm income. The F ratio value of 22.774 was significant at 5% level. All the variables had expected positive signs suggesting direct relationships with adoption level of agricultural technologies. However, only education, annual income, contact frequency, farm experience, age and cooperative duration were significant. Sex of the farmer, marital status and household size were not significant. This, therefore suggest that some socio-economic characteristics of farmers especially the number of years spent in cooperatives have influence on rural farm income. The null hypothesis that cooperative do not have significant effect on rural income was therefore rejected. So we conclude that cooperatives have effect on adoption level of agricultural technologies.

Table 4.8. Mean rating of the hindrances to adoption of improved agricultural technologies among FADAMA rice farmers

	Mean (X)	SD	Decision
Inadequate extension services	3.62	2.091	Accept
Market value of rice	2.41	3.892	Reject
Illiteracy	3.90	2.328	Accept
Individualism among farmers	3.46	1.983	Accept
Poor access to information	3.87	1.873	Accept
Cost of adoption	4.00	2.897	Accept
Adverse effects of adoption	2.71	2.875	Reject
Volume of production	1.97	3.011	Reject
Low awareness	4.21	1.983	Accept
Government policies	2.15	0.528	Reject
Farmers general attitude to innovations	3.38	1.7835	Accept
Tasking nature of adopting new technologies	2.14	1.094	Reject
Socio-cultural reasons	2.67	2.863	Reject
Type of media channel in use	3.51	2.330	Accept

Table 4.8 revealed that major hindrances to adoption of improved agricultural technologies include inadequate extension services, illiteracy, individualism among farmers, high cost of adoption, general society attitude to innovations and the type of media in use. It showed that market value of rice, volume of production, government policies, adverse effect of adoption and socio-cultural reasons do not constitute hindrances to adoption of improved agricultural technologies.

Test of hypotheses 4

Ho: Farmer specific characteristics and society characteristics do not constitute significant hindrance to adoption of improved agricultural technologies.

Table 4.9. One-Sample Test on hindrances to adoption of improved agricultural innovation among rice farmers

	Test Value = 0					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Inadequate extension	21.951	319	.000	1.40000	1.2724	1.5276
Market value of rice	19.565	319	.000	1.85000	1.6608	2.0392
Illiteracy	25.389	319	.000	3.43333	3.1627	3.7039
Cost of adoption	27.712	319	.000	2.38333	2.2112	2.5554
Poor access to information	28.626	319	.000	2.50000	2.3252	2.6748
Adoption adverse effects	21.067	319	.000	2.41667	2.1871	2.6462
Volume of production	28.492	319	.000	2.71667	2.5259	2.9075
Low awareness	22.984	319	.014	2.97634	2.0804	2.0956
Type of media in use	26.983	319	0.320	2.89744	2.8075	3.1097
Socio-cultural reasons	24.9816	319	0.657	2.1897	2.4081	2.7862
Tasking nature of adoption	27.1708	319	0.715	2.0987	2.0021	2.6109

According to Table 4.9, seven out of eleven factors were significant at 0.05 level of significant with very high t-ratio. Therefore, the null hypothesis was rejected. So we conclude that farmer-specific and institutional-specific factors hinder adoption of improved agricultural technologies.

Discussion of Findings

This study evaluated the determinants of improved technology adoption among cooperative rice farmers who participated in the FADAMA programme in Enugu State. Findings revealed that adoption level of these new technologies (spacing, use of varieties, line planting, fertilizer application, time application) This is in line with the views of Kudi *et.al* (2011) that there is increasing adoption of line planting and fertilizer application among rice farmers. However, unlike the findings in Ayinde *et.al* (2010) about agricultural technologies adoption, many farmers in the area studied had low rate of adoption for

spacing and lime application. This difference can be attributed to cultural and social orientation of the farmers.

Interestingly, most of the determinants of adoption as revealed in this study are similar to findings made in previous studies, except in the case of age, parents' occupation and status of the farmers in the farmers association. It is dissimilar with the findings of Adekunle *et.al* (2005), who posited that age and parents occupation affect adoption. The findings in this study is similar to Lawal and Oluleye (2008) who agreed that education, annual income, farming experience, cooperative membership and literacy level of farmers affect the level of adoption.

Surprisingly, new factors introduced that are not conventional in adoption literature such as motive of farming, attitude of extension agents, frequency of contact with extension agents, source of information and training attendance were very significant. Some of these factors, however, were mentioned in Laugyin and Nejybuan (2008). The researchers observed that most significant determinants of adoption include education level of the farmer, frequency of contact with extension agents, cooperative membership, training attendance and attitude of extension agents. These findings have important policy implication because they have shed light into why many extension services failed to achieve its objective. It is difficult for farmers to adopt new technologies if they do not trust the source of the information, if the attitude of the extension worker is unfriendly, and if the number of contact is not enough to affect technology transfer. Availability of success stories has merged into an important determinant of adoption. Farmers will be more disposed if they see evidence of adoption. The urge to adopt new technology will be high when there is reliable and easy to see evidence of adoption. This implies that extension agents and other technology transfer agents should ensure that success stories and evidences are available whenever they interact with farmers.

This study reiterated the critical importance of cooperative in the adoption process. Just like in Magaji (2005), this study found out that cooperative was a significant influencer of adoption. They provide platform for information sharing, guarantee services, handling of objections and reducing the cost of adoption. As Kindi *et.al* (2011) noted, cooperatives minimize the risks involved in adopting new technologies and provide weaker farmers access to information and opportunities to improve their output. Similar study by

Akinwunmi and Jojo (2000) observed that there was higher adoption rate of agricultural technology among cooperative farmers than among non cooperative farmers. Cooperatives provide avenue for technology transfer and rural learning especially for less literate farmers. This justified the level of attention paid to them by government. In recent times, 70% of all government assistance to farmers was delivered through cooperatives, and this policy direction has received overwhelming commendation. The policy implication of this finding is that it justifies increased attention given to cooperatives. This means that investing in capacity building of agricultural cooperatives will have significant effect not only on the agricultural sector, but on national development.

In line with the findings of Buhati *et, al* (2012), illiteracy, inadequate extension services, low awareness and cost of adoption stand out as most significant hindrances to adoption of improved agricultural technologies. This finding is in contrast with Magaji (2005) who observed that volume of production and market value of rice hinder technology uptake. His argument was that if the market value of a produce is high, farmers will be eager to increase yield in order to make more profit. However, this study reveals otherwise. Government policies, adverse effects of adoption and culture were insignificant constraints to adoption of improved agricultural technologies. Apart from the four constraints listed above, this study shows that type of media used in technology transfer, individualism among farmers and general societal attitude towards innovations hinder adoption of improved agricultural technologies. The implication of this finding is that both government, policy makers, analysts and cooperative leaders have known hindrances facing adoption. This knowledge is critical because it will inform decisions on how to mitigate the constraints.

Conclusively, this study has made valuable contributions to the field of agriculture and cooperative especially as regard adoption. It has expanded the frontiers of knowledge in adoption behavior by focusing on adoption drivers of rice farmers who not only belonged to cooperatives but also participated in FADAMA programme. It has enriched the literature by introducing new determinants such as frequency of contact, source of adoption information, motive for farming, number of training attended and availability of success stories. These determinants are relatively new in literature unlike educational

qualification, age and farming experience. Apart from solidifying the increasing importance of cooperatives in adoption theory, the study also made in-roads in identifying new constraints to adoption. The study is, therefore, significant because it has filled the gap in literature by bringing the views of cooperative rice farmers to literature. It has also generated a lot of policy implications which can help to chart a new course in agricultural technologies adoption.

CHAPTER FIVE

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

This concluding Chapter deals with the summary of the research findings, implications of the study, recommendations and concluding remarks.

5.1 Summary of Findings

- Members of cooperative rice farmers who participated in FADAMA programme have significantly adopted improved agricultural technologies (t=22.174; 0.05 level of significance). This adoption was more significant in the area of using varieties, line planting and fertilizer application.
- Major determinants of adoption of improved agricultural technologies among members of rice cooperative farmers in clued educational qualification, farm size, annual income, frequency of contact with extension agents, cooperative membership, others are farming experience, source of information on adoption, number of trainings attended, literacy level of farmers, attitude of extension agents and availability of success stories.
- Cooperative membership had significant effect on adoption of improved agricultural technologies. Cooperative members have high propensity to adopt new agricultural technologies than non-members. Cooperatives contribute to adoption, sharing of information, motivating people towards adoption and providing platform for aid and assistance.
- Significant hindrances to adoption of improved agricultural technologies are inadequate extension services, illiteracy, individualism among farmers, poor access to information, high cost of adoption, low awareness, societal attitude to new innovations and the type of media channel used in the technology transfer.

5.2 Conclusion

Government at every level has come to the realization that food security is attainable not only with funding alone but improved technology. One of the objectives of the FADAMA programme is technology transfer and cooperatives have played leading role on this aspect. Rice farming is currently receiving attention in Nigeria because of the government effort at reducing importation and increasing

local production. Increase in output and revenue can be achieved using the right technology. This study has revealed areas of strength and weaknesses in technology adoption among rice farmers. It has elaborated on factors that drive, encourage or hinder adoption. It has also brought to the limelight the critical role of agricultural cooperatives in achieving the Nigerian rice revolution. Indeed, a lot of improvement has been made in adoption of improved agricultural technology, but there is still need to strive higher. Understanding of significant determinants that propel adoption will help government, policy makers and cooperatives to address objections and increase rate of adoption.

5.3 Recommendations

- Extension services need to be energized and revitalized by employment and deployment of competent, motivated and well remunerated work force with strong work ethics. There is also the need for effective supervision of extension services and retraining of staff in order to update their skills and keep them at pace with new technologies
- Increased emphasis on capacity building agricultural cooperative through effective linkages and strong apexes. Since studies have established the important roles of agricultural cooperatives in rural development, efforts shall be made to straighten their capacity. The cooperatives in Anambra State are operating as isolated entities and with low volume of business. The presence of an apex body at national and district level would help to consolidate these small volumes and enable the cooperatives to benefit from economies of scale and meet the buyers' required volumes.
- Mode of delivery of agricultural extension services need to be revisited. There is the need to increase the frequency of visits, as well as the media channel employed in the technology transfer. Their curriculum should include influencing farming motives, breaking cultural barriers, first time inertia to adoption and motivating farmers to attend trainings. Success stories that are reliable and accessible should also be used during extension activities.

- Cooperatives should maximize every opportunity they have to get trained and acquire skills. There is growing need for enhancing members' technical skills and regular training in cooperative knowledge to help them gain a better understanding of the cooperative's function. Farming is an occupation that needs improved skills and training is important to reduce individualism and increase large scale farming. This will improve the quality of member's participation and steer the cooperatives toward success.

5.4 Contribution to knowledge

This study established that members of cooperative rice farmers who participated in FADAMA programme have significantly adopted improved agricultural technologies (t=22.174; 0.05 level of significance), cooperative membership had significant effect on adoption of improved agricultural technologies and significant hindrances to adoption of improved agricultural technologies are inadequate extension services, illiteracy, individualism among farmers, poor access to information, high cost of adoption, low awareness, societal attitude to new innovations and the type of media channel used in the technology transfer.

5.5 Suggestions for further Research

This research work intended to evaluate the determinants of adoption of improved agricultural technologies among FADAMA rice farmers cooperative societies in Enugu State, Nigeria. Other researchers may in the future study the determinants of adoption of improved agricultural technologies among FADAMA rice farmer's cooperative societies in Anambra, Ebonyi, Abia and Imo States in Nigeria.

REFERENCES

Adesina, A.A. (2014). Building ladders out of Poverty: Lagos, Nigerian Institute of International Affairs.

Abdul, R.C. (2013). Information Communication Technology for Agricultural Development. *Journal of American Science*.

Adejare, G.T. &Arimi k. (2013). Determinants of Labour use for selected tree Crops in Oyo and Ondo States, *Nigeria New York Science Journal*.

Adebayo A.E. and Tologbonse E.B. (2005) Adoption and diffusion of innovations. In Adedoyin (eds) Agricultural Extension society of Nigeria (AESON).

Adeoye, A., Yusuf S. A. Balogun, O. L. & Carim-Sanni, A. (2011), Rural Infrastructural Development and Profitability of Farmers Under Fadama II Project in Oyo State, Nigeria, World Rural Observation: 3 (2), Science Publication.

Adedayo, A. & Yusuf, O. R. (2004). Cooperatives and Poverty Alleviation in Rural Settlements of Kwara State, Nigeria. Savanna, Vol. 19, No. 2. pp. 123-131.

Adebayo, K., Omotayo, A. M., Garforth, C. J. and Awotunde, M. (2002). Small farmers' perception of the characteristics of new farm practices in Ogun State, Nigeria. Journal of Extension Systems.

Adegbite, D. A., Oloruntoba, A. O, Adubi, K. O, Oyekunle, O. & Sobanke, S B., (2008). Impact of National Fadama Development Project II on Small Scale Farmers in Ogun State: Implication for Agricultural Financing in Nigeria, Journal of Sustainable Development in Africa, Vol. 10, No.3 Clarion University, Pennsylvania.

Aderinola E.A (2008) strategic planning and mission review for FADAMA project in Ondo State, Nigeria A paper presented at seminar on supervision management of available resources for FADAMA development projects in Ondo State, December, 2008.

Adesina, A.A. & Baidu-Foroson, J. (1995). Farmer's perceptions and adoption of New agricultural technology: Evidence from analysis in Burkina Faso and Guinea West Africa. Agricultural economics.

Adesoji S.A, Frainde A.J and Ajayi A.O (2006) determinants of training needs of Nigeria and implications for extension workers. *Journal of applied science 6, 3082 – 3088.*

Adesope, O.M. Matthews – Njoku, E.C., Oguzor, N.S. &Ugwuja, V.C. (2012). Effect of socio-economic characteristics of farmers on their adoption of organic farming practices, crop production technologies, Dr. Peeyush Sharma (Ed) ISBN: 978-953 -307-787-1, in Tech, available from: http://www.intechopen.can/books/crop-production. technologies/effect of socio-economic. characteristics-of-farmines-n-their-adoption of organic farming-practices.

Adeyanju, A. M. and Mbibi, J.O.J. (2005). Getting the right agricultural messages to the Northern Farmers. The Challenges of the 21st century: A Paper presented at the National Conference on Prospects and Problems of Agricultural Development; Research Ahmadu Bello University, Zaria, Nigeria; June 29 – July 2nd .

Adisa, B. & Okunade, E. (2005). Women in Agricultural and Rural Development in: Adedoyin S.F. (Ed). Agricultural Extension in Nigeria. Ilorin: Agricultural Extension Society of Nigeria. Pp. 69 -77.

Agbamu JU (2005). Problem and Prospects of Agricultural Extension Service in Developing Countries. In: Agricultural Extension in Nigeria. S.F. Afolayan (Ed.) Ilorin AESON pp. 159 -169.

Agbo F. & Chidebelu S. (2010). Socio-economic determinants of cooperative societies access to the service of the Nigeria Agricultural Cooperatives and Rural Development Bank. Institute Veolia Environment http://factsreports.revues.org/614.

Agrawal A. (2001) common property institution and sustainable governance of resources. World Development 29 (10) 1649 – 1672.

Ahearn M.C, Korb P. and Banker D. (2005). The industrialization and contracting of agriculture*". Journal of agricultural and applied economics, 37: 347 – 364.*

Ajah, R. O. (2009). La Fin du Monde: Etude Postcoloniale du Chant du Lac d'Olympe Bhêly-Quenum. Agora : Journal of Foreign Language Studies, 3, 144-163

Ajayi A.O., Farinde A.J., and Laogun E.A. (2003) Women farmers training needs and their corrected for effectives extension programme and poverty reduction in Oyo State Nigeria. Journal extension system 19. Pp 91 – 102.

Ajibefun, I.A. (2006). Linking socio-economic and policy variables to technical efficiency of traditional Agricultural production: Empirical evidence from Nigeria. Paper presented at International Association of Agricultural Economist' Conference. Gold Coast, Australia, August 12-26

Aker, J.C., Block, S. Ramachnadran, V. & Timer C.P. (2010). West African Experience with the World Rice Crises, 2007 – 2008.Chapter 8 in the Rice Crisis: Markets, Policies and Food Security. David Dave (Ed). The Food and Agriculture Organization of United Nations and Earth Scan.

Akinola, A.A.R., Adeyemo & Alene A.D. (2011). Determinant of Adoption of Balanced Nutrient Management System Technologies in the Northern Guinea Samna of Nigeria: A Multinational Legit Approach. *International Journal of Agricultural Economics and Rural Development.*

Akinwumi A. Adesina & Jojo Baidu-Forson (1995).Farmer's Perceptions And Adoption Of New Agricultural Technology Evidence From Analysis In Burkina Faso And Guinea West Africa. Agricultural Economics 13 (1995) 1-9

Amahalu A.C (2010) Financing cooperatives. Readings in cooperative economics and management, Umebali E.E (Ed) Enugu: computer, Edge publishers.

Anaeto C., Asiabaka, C.C., Nnadi, F. Ayaero J., Aja, O., Ugwuoke F., Ukpongson M. and Onweagba A. (2012) The role of extension officers and extension services in the development of agriculture in Nigeria. Wind Pecker. *Journal of Agricultural Research Vol. 1 (6) 180-185.*

Anigbogu T.U. (2012) contribution of farmers multipurpose cooperative societies (FMCS) to food production and rural development in Anambra State (unpublished thesis) dept of cooperative economics, Nnamdi Azikiwe University Awka.

Aria L.O. (2006) Information provision to farmers in Africa. The library – Extension – service Luckage: World Library and information organs 72, 2nd IFLA General conference and Congress, Seoul Korea.

Asiabaka, C.C., and Michelle, Kenyon (2002). The Development, Dissemination and Adoption of Technologies Directed at Improving Availability of Clean yam planting material in Nigeria and Ghana. Report on a Study Mission

Commissioned by UK Government Department for International Development (DFID) Crop Protection. Nigeria.

Asiabaka, C.C. (2007) The challenges of Research – Extension – Farmer – Input System (REFILS) in Agricultural Development and Delivery in South East Agro-Ecological Zone. Paper presented at the 23rd annual REFILS Workshop, Awka, Anambra State.

Agwu, A.E, Ekwueme J.N. and Anyanwu A.C. (2008) Adoption of improved agricultural technologies disseminated via radio farmer programme by farmers in Enugu State Nigeria. Journal of Biotechnology.

Ayinde, O.E.; Adewumi, M.O; Olatunji, G.B. and Babalola, O. A (2010). Determinants of Adoption of Downy Mildew Resistant Maize by SmallScale Farmers in Kwara State, Nigeria. Global Journal of Science Frontier Research. 10(1-1.0):32-35.

Badstue L.B, Belon M.R, Juarez Z, Rosa I.M, Solano A.M (2002) social relations and seed transactions: small scale farmer access to maize landraces in the central valleys of Oaxaca: preliminary findings. Economics working paper 20-20 DF Mexico, Maxico: CIMMYT.

Bain J.S (1959) Industrial organization New York: John Wiley and sons.

Bajoga Yahaya Umar and Adebayo Abel A (2006)THE IMPACT OF FADAMA DEVELOPMENT PROJECT ON THE LIVING STANDARD OF DRY SEASON FARMERS OF GOMBE STATE. FUTY Journal of the Environment, Vol. 1 No.1, July 2006 © School of Environmental Sciences, Federal University of Technology, Yola – Nigeria.. ISSN 1597-8826

Banyte J. and Salickaite R (2015) "Successful diffusion and adoption of innovations as a means of increase competitiveness of Enterprises".

Barney, Jay (1991). Firm Resources and Sustained Competitive Advantage. JOurnal of Management. 1991, Vol. 17, No. 1, 99 - 120

Bello A. (2004) Federal Government's (FG) goal is to move from sub sorteme to surplus in the sprout, official Newsletter of the Nigeria Agricultural Cooperative agricultural Extension.

Bereh, H. (2002) Connecting farmers worldwide through Radio: Low external input and Sustainable Agricultural (LEISA).

Bonabana-Wabbi J. (2002). Assessing Factors Affecting Adoption of Agricultural Technologies: The Case of Integrated Pest Management (IPM) in Kumi District, Msc. Thesis Eastern Uganda.

Bray F.U (2008) Cooperative development in Nigeria contending with the legacy of colonial government. Nsukka, university of Nigeria.

Central Bank of Nigeria (CBN) (2010). The changing structure of the Nigeria Economy and Development Realm Communication Lagos.

Characteristics of innovations and innovation adoption in public organization: Assessing the role of manager. 2006 – wiley online library.

Chatura B.Ariyaratne, Allen M.Featherstone & Michael R. langemeier (2006). What determines productivity growth of agricultural cooperatives? Journal of Agricultural and Applied Economics, 38, I (April, 2006):47-59

Conley, T. & Udry C. (2000). Learning About a New Technology: Pineapple in Ghana. Working Paper Yale University.

Custom re-imposes ban on rice importation (2016). Vanguard News. www.vanguardng.com/.../custom-re.

Davis C.G and Gillespie J.M (2007) "Factor affecting the selection of business arrangement by U.S Hog farmers" Review of agricultural economics, 29: 331 – 348. http://www.ageconsearch.umn.edu/.../crawfish %20 marketing

Deji, O.F. (2005). Membership of Cooperative Scientist and Adoption Behaviour of Women Farmer: Implication from Rural Development. *Journal of Social Sciences.*

Doss, C.R. (2003). Understanding Farm Level Technology Adoption: Lessons Learned From CIMMYT's Micro Survey in Eastern Africa. CIMMYT.

Echetama J.A. (2011) Determinants of level of adoption of Improved Agricultural Technologies among Radio Farmer Programme listeners in Imo State, Nigeria. Ph.D Dissertation, Michael Okpara University of Agriculture, Umudike, Umuahia.

Egbule P.E. and Njoku, E.M. (2008) Mass Media Support for adult Education in Southern Nigeria: DVO International Adult Education and Development. Edition No. 56.

Ekumankama O. (2000) Farmers level of satisfaction sources in Umuahia, Abia State, Nigeria. *Journal of sustainable Agricultural and Environment. Vol 2.*

Ejiofor (2007), cited in Ibeawuchi, I. Echeme & Nwachukwu, C.C. (2010), An Investigation on the Impact of FADAMA II Project Implementation in Imo State. American Journal of Scientific and Industrial Research, Science Huβ, http://www.scihub.org/AJSIR ISSN: 2153-649X doi:10.5251/ajsir.2010.1.3.532.538.

ENADEP (2008). Information on Women in Agriculture Package: Annual Report.

Ewuola, S.O. and Ajibefun A.I. (2002) selected media and socio-economic factors influencing innovation adoption by small scale farmers. Empirical evidence from Ondo and Ekiti States of Nigeria. *Applied Tropical Agriculture Vol.II.*

Rogers, Everett M. (1995) DIFFUSION OF INNOVATIONS Fourth Edition. THE FREE PRESS A Division of Simon & Schuster Inc. 1230 Avenue of the Americas New York, NY 10020

FAO (2002) Agricultural Knowledge and information system for Rural Development, (AKIS/RD) www.lesd.worldbank.org/extension.

FADAMA II Project implementation in Imo State American Journal of Scientific and industrial Research, science HUB: http://www.scihub.org/AJSIR ISSN: 2153 – 649X do::10.525/ajsir. 2010.

FAO (2009).

FAO (2001). Sustainable Development, Proceedings: Executive Summary Report on Small Farmers Group Association Brining the Poor Together.

FAO (2011)Videos for Agricultural Extension. Note 6. GFRAS Good Practice Notes for Extension and Advisory Services. GFRAS: Lindau, Switzerland.

FAOSTAT (2012) Faostat.fao.org 2012.

FAOSTAT (2014) Faostat.fao.org 2014.

Federal government has concluded plans to end the importation of rice from 2017. http://www.naij.com/604443 - fg-set-ban.

Fikru, A. (2009). Assessment of Adoption Behaviour of Soil and Water Conservation Practices in the Koga Watershed, Highlands of Ethiopia. MSc. Thesis, Cornell University.

Fisher E. & Dain, M. (2012).Linking Small Holders to Markets: Determinants and Impacts of Farmer Collective Action in Kenya .World Development.

Fulton J.R and Adamowicz W.L (2003) "Factors that influence the commitment of members to their cooperative organization" *Journal of Agricultural cooperation, 8: 39-53 ……. http://www.researchgate.net*

Fulton M. (1999) "Cooperatives and member commitment "*the finish journal of business economics 4: 418 – 437. http://www.ita/hse/fi/1999/4/its 1999 64.pdf.*

Ghosh, A. K. and Maharjan, K. L. (2001). Impacts of Dairy Cooperative on Rural Income Generation in Bangladesh. Journal of International Development and Cooperation, Vol. 8, No. 1, pp. 91-105.

Ghosh R.K., Goshanir A. & Mazumdan A.K. (2005). Adoption Behaviour of the Diary Farmers in Relation to Artificial Insemination in Cooperative Farming System. Invest Bengal University of Animal and Fishery Sciences 68 K.B. Sarain, Belgachie, Kolkate.

Gurstern M. (2003) Effective use: A community information strategy beyond the digital divide.

Halakalti, S.V., Kamanaddi V. & Groda, D.S.M. (2007). Determinants of Adoption of Diary Farming Technologies by Rural Women Under SGSY Scheme, Karnatka J. Agric Science.

Hillaid R.L. (2006) Farm and Rural Radio, some Beginnings and models (http://www?farmeradionetwork.org).

Holloway G., Nicholson, C.Delgado,C. Staal, S. &Ehui, S. (2007). Agro industrialization Through Institutional Innovation: Transaction Costs, Cooperatives and Milk-Market Development in the East African Highlands. Agricultural Economics.

Hughes (1997). Irrigation principle and practice, John Willery and Sons, Inc. UK, Third Edition.

Idachaba F.S. (2000) "The nature of Nigeria food problems*" Journal of agricultural science and Technology.*

Idirisa, Y.L., Ogunbameru,B.O. & Madukwe, M.C. (2012). Logit and Tobit Analysis of the Determinants of Likelihood of Adoption and Extent of Adoption of Improved Soybean Seed in Bornu State, Nigeria.

Iheanacho A. C, Abaja A. & Harina L (2007). Beneficiating assessment of the second National Fadama Development: A draft report submitted to Adamawa SFDO, 2007

International Food Policy Research Institute (IFPRI, 2002) Videos for Agricultural Extension. Note 6. GFRAS Good Practice Notes for Extension and Advisory Services. GFRAS: Lindau, Switzerland.

Isife, B.L. and Madukwe M.C (2005) Constraints to farmers' effective participation in agricultural extension programme of non-profit non-governmental organizations in Southern – Eastern Nigeria. Global Approach to Extension Practice (GAEP).

Iwena O.A. (2012) Essential Agricultural Services. TONAD Publishers Limited.

Jone G.E. and Garforth C. (2009) The History, development and future of agricultural Extension in Swanson, B. "Improving Agricultural Extension: A reference manual (3rd edition)" FAO.

Juliano B.O. (1993) "Rice in human Nutrition" Food and Agricultural Organization of the United Nations.

Juma,C. (2010). The New Harvest: Agriculture Innovation in Africa. Oxford University Press.

Kassal, M. K. (2000). Information Utilization on Cassava Production Among Women in Iddo Local Government Area of Oyo State. An Unpublished M.Sc Project in the Department of Agricultural Extension and Rural Development, University of Ibadan.

Katehova A.L and Miranda M.J (2004) "Two – step econometric estimation of farm characteristics affecting marketing contract decisions" American journal of agricultural economics 86: 88-102 www.agmanager.info paper. Pdf.

Kimuyu, P. and Omiti, J.(2000). Institutional impediments to access to credit by Micro and small scale enterprises in Kenya, Discussion Paper No. 026/2000 Institute of Policy Analysis and Research, Nairobi, Kenya.

Kparmweng, T. & Esu I.E (1990). Characteristics and agricultural land use of Fadama soils in the savanna Region of Nigeria: Review, 11: 116 – 131

Kudi A.M, Ani S.O & Oredipe A.A (2008). Poverty reduction and increased productivity through empowerment" CPU – NFDO Fadama Development Project October 2008.

Kudi, T.M., Bolaji, M. Akinola,M.O. & Naa, I.D.H. (2011). Analysis of Adoption of Improved Maize Varieties Among Farmers in Kwara State, Nigeria. *International Journal of Peace and Development Studies*.

Kuponiyi F.A. (2000) Mass Media in Agricultural Development: The use of Radio farmers of Akinyele Local Government Area of Oyo State Nigeria. *Nigeria Agricultural Development Studies.*

Langyin, A. & Nejybuam N. (2008).Assessing the Influence of Neighborhood Effect on the Adoption of Improved Agricultural Technologies in Developing Agriculture.*African Journal of Agricultural and Resource Economics*.

Larocque, P., Kalala, J. & Gaboury, A. (2002). The Impact of Savings and Credit Cooperatives in Burkina Faso. Ottawa: Developpement International Desjardins.

Lawal, A. F, Liman, A. & Lakpene. T (2014). Adoption of yam minisett technology by farmers in Niger State, Southern Guinea savannah, Nigeria. Nigerian Journal of Agriculture, Food and Environment. 10(1):65-71

Lawal, B.O. Saka, J.O. Oyegbami,A. & Akintayo, I.O. (2005). Adoption and Performance Assessment of Improved Maize Varieties Among Small Holder Farmers in South West Nigeria. *Journal of Agricultural and Food Information.*

Lawal, J. O. & Oluyole, K.A. (2008). Factors Influencing Adoption of Research Results and Agricultural Technologies Among Cocoa Farming Households in Oyo State, Nigeria. *International Journal of Sustainable Crop Production*.

Leeuwis C and Vanden Ban, A. Communication for Rural innovation Rethinking Agricultural Extension (3rd edition) Blackwell Publishing.

Les Robinson (2009). A Summary of Diffusion of Innovations http://www.enablingchangecommon/summarydiffusion theory pdf.

Mac Donald J., Perry J., Ahearn M., Banker D., Chambers W., Dimitri C., Key N., Nelson K., and Southard L., (2004) "contracts, markets and prices: organizing the production and use of agricultural commodities" agricultural

economic report number 837, economic research service U.S Department of agriculture 2004.

Magaji, S. (2005).Introduction to Project Evaluation. Abuja: Sanitex Press.

Marcone, S. (2010). How Cooperatives Work for Women Workers-Voices from the Movement, Retrieved from www.Ilo.org/coopafrica.

Marrique,E., Marcen, F., Maza, M. &Olizola, A. (2002). Commercial Strategies and Horizontal Diffusion of Innovations in a Sheep Farming Cooperative Enterprise, the Case of Cane Arggon".CIHEAM-options Mediterranean's.

Marshall G. (1988). A dictionary of sociology. New York oxford university press.

McCarthy N., Dutilly – Diane, C. Drabo B (2002) cooperation collective action in natural resource management in Burkina Faso: A methodological note. CAPRI working paper 27. Washington DC: International food policy research institute.

Mazher, A., Sheikh A.D., Muhammed, S. and Ashfaq (2003) Role of electronic media in the adoption of Agricultural technologies by farmers in the central Punjab – Pakistan: *International Journal of Agriculture and Biology Vol.5.*

Mgbada J.U. (2002) Elements of Agricultural Extension, Rich Field, Franklin and Science Publications Enugu, Nigeria.

Mgbada J.U. (2010) Agricultural Extension; The human Development Perspective. Computer Edge Publishers Enugu.

Mohammed T. (2002) Farmers awareness building on integrated pest management (IPM) researchers report. ICIPE/EARO Vegetables IPM Project.

Morris, M.L., Tripp, R. &Dankyi, A. A. (1999).Adoption and Impacts of Improved Maize Production Technology.A Case Study of the Ghana Grains Development Project. Economics Program Paper.

NAFES Extension (2005) Consolidating Extension in the Lao PDR Natwine Agricultural and Foresting Extension Services, Vientians.

Namuisha, A. (2010). Hurdles to Women Empowerment in Coop Africa, Regional Technical Cooperative Programme of ILO. Retrieved from www.ilo.org/coop.

National Population Commission (2006). Estimated population figures. National Population commission of Nigeria, Abuja

National Research Council (1966) African Rice Lost Crops of Africa1. National Academies Press. ISBN 978 – 0 – 309 – 04990 – 0. Retrieved 2008.

NFDP II (2003). Fadama II poverty reduction through empowerment, A publication of PCU – NFDO Abuja, Nigeria

Nigeria ban rice importation through landborders. www.premuimtimesng.com/.../200635. 22 March, 2016.

Nnadi F.N. and Akwikwu (2005), Rural women's response to selected crop production technologies in Imo State, Nigeria. Global Approach to Extension Practice (GAEP).

Nsoso, S.J. & Ramasima, M.C. (2004).A Survey of Tradition Beef Cattle. Cattle Farmers in Southern Botswana: Demographic Parameters and Adoption of Certain Improved Management Practices. *South African J. Agric Ext.*

Nwachukwu, I. & Kanu, R. U. (2011). Globalization and rural development strategy of Michael Okpara University of Agriculture, Umudike: A paradigm shift. In I. Nwachukwu, & K. C. Ekwe (Eds.). Globalization and rural development in Nigeria (pp. 24-37). Abia State: Extension Centre, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

Nwachukwu, I.(2008). Agricultural Extension in Nwachukwu I. and Onuekwusi Gideon (eds) Agricultural Extension and Rural Society. Enugu. Snapp Press.

Oakerson R.J. (1992) Analysing the commons: A framework in making the commons work. Theory practice and policy. Ed. D.W. Bromley. San Francisco, CA, USA. ICS Press.

Obayelu A. Elijah & Ogunlade, I. (2006). Analysis of the uses of information and communication technology for gender empowerment and sustainable poverty alleviation in Nigeria. International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2006, Vol. 2, Issue 3, pp. 45-69.

Odoemenem, I. U., & Obinne, C. P. O. (2010). Assessing the factors influencing the utilization of improved cereal crop production technologies by small-scale farmers in Nigeria. Indian Journal of Science and Technology, 3(2), 180-183.. Determinants of Adoption of Downy Mildew Resistant Maize by

SmallScale Farmers in Kwara State, Nigeria. Global Journal of Science Frontier Research. 10(1-1.0):32-35.

Ogundele S.O. (2001) FADAMA production in Ondo and Osun State Nigeria. An unpublished B.tech thesis, department of Agricultural Economics and Extension, FUT, Akure.

Ogunjimi, Lawrence Abiodun O. & Adekalu, K.O. (2002). Problems and constraints of small-scale irrigation (FADAMA) in Nigeria. Food Reviews International 18(4):295-304 DOI: 10.1081/FRI-120016207

Ohajianya D.O. and Onu D.O. (2005) Adaptive of improved maize varieties in Imo State as a two-stage decision process. Global Approach to Extension Practice (GAEP).

Okafor E.O. (2012) Members of cooperative societies and adoption behavior of farmers in Awka North Local Government Area of Anambra State, Nigeria. Ph.D Seminar, (unpublished thesis) Nnamdi Azikiwe University Awka.

Okunlola J.O. (2000) Effect of the government micro-credit scheme on food crop production in Ondo State. Proceeding of conference of agricultural extension society in Nigeria.

Oladele O.I. (2006) Learning enhancement factors among farmers in mezam Division of North West Province of Cameroon. *Austrian Journal of Adult Education.*

Oladimeji I.O. (2006) Multilingualism of farm Broadcast and agricultural information in Nigeria: *Nordic Journal of African studies*.

Olaolu M.O, Ajayi A.B and Akinnagbe O.M. (2008) impact of National FADAMA development project II on rice farmers' profitability in Kogi State Nigeria. *Journal of applied science 6.*

Oluma, J.O., Murithi, M.F., Mwanji, W. Verkuji, H., Macharia, g. & Groote, H.D. (2006). Adoption of Maize Seed and Fertilizer Technologies in Embu District, Kenya, Mexico, D.F. CIMMYT.

Olusanmi, H.A (1996). Impact of higher agriculture education of food and agriculture, Special Publication Vol. 8 1996.

Olusegun A.F., Dare A. &Begho T. (2013). Factors Influencing Adoption Decisions of Maize farmers in Nigeria .*International Journal of Food and Agricultural Economics.*

Onoh F.A (2014) Analysis of the effects of activities of agricultural cooperatives societies on agricultural production in Enugu State (unpublished thesis). Dept of cooperative economics Nnamdi Azikiwe University Awka.

Onu, D.O. (2003) The Farmer and Soil Conservation and Erosion Control in Imo State Nigeria: Personal and farm enterprise characteristics that influence change behavior. *Journal of Technology and Education in Nigeria (JOTEN*).

Onu, D.O. (2005) Rural Development and Agricultural Extension Administration in Nigeria: *Global Approach to Extension Practice (GAEP) VOL. 1, No1, PP32-46.*

Onu, D.O. and Anyanwu .C. (2000) Effective Agricultural and Rural Development in Nigeria through extension education. In Ikenne A.I (ed), the challenges of Agricultural National Development, Enugu Optimal Computer Solution Ltd.

Onugu, C.U. (2008). Advancing Women Participation in Agricultural Development Through Cooperative Societies; The Case of Women in Agriculture Programme in Anambra State, Nigeria. *Nigerian Journal of cooperative Economics and Management, Nnamd iAzikiwe University, Awka*.

Onyeze C.N (2010) "An assessment of the performance of cooperative thrift and credit societies in Igboeze North local government area Enugu State" a doctoral seminar paper: dept of cooperative economics. Nnamdi Azikiwe University Awka. Anambra State.

Ostrom E. (1992) The rudiments of the theory of the origins, survival, and performance of common property institution in making the commons work: theory, practice and policed. D.W. Bromley, San Francisco CA, USA: ICS Press.

Oyemade, B.T. (2003). Influence of Socio-Economic Factors on Continued Use of Selected Post harvest Technologies Among Women Processions in Oyo State. An Unpublished M.Sc Project in the Development of Agricultural Extension and Rural Development, University of Ibadan.

Patel, A.U. & Anthonio, Q.B.O. (2006). Farmers Wives in Agricultural Development: the Nigerian Case. Paper Presented at XVIL International Congress of Agricultural Economics, August 20 – 29 Sao Paulo Brazil.

Phases of the adoptive innovation in organizations: Effects of environment, organization and top managers.

Place F. and Swaltow B.M (2002) Assessing the relationship between property rights and technology adoption in small holder agriculture issues and empirical methods. In meinzen Dick, Ruth S. Know, Anna. Place, Frank and Swallow Brent M. ed. Innovation in natural resource management. The role of property rights and collective action in developing countries. Baltimore and London: John Hopkins University Press.

Potecte A. and Elinor O. (2003) in pursuit of comparable concepts and data about collective action. CARPI Working paper 29 Washington Dc: international food policy research institute. Proceedings of the National farming systems research network workshop held in Calabar Cross River State Nigeria . 14 – 16 August 990, pp 5-17.

Prakash, D. (2008). Rural Women Food Security and Agricultural Cooperatives, Japan Agricoops Managements training Project for Asia. International Cooperative Alliance (ICA).

Pur J.T. and Guarry M.M. (2008) Determinants of effectiveness of Electronic media in Agricultural information delivery in Yola North Local Government Area of Adamawa State, Nigeria. *Journal of production Agriculture and technology.*

Ramirez R. Quarry W (2004). Communication and strategies in the Age of Decentralization and Privatization of Rural Services: Lessons from Two African Experiences. AGREN Network Paper No. 136: July

Rice: https://en.m.wikipedia.org/wiki/rice.

Roger, (2003) Wikipedia http://en.

Rogers E. (2003) Diffusion of Innovation 5th edition. Simon and Schuster.

Rogers, E.M. (2003). Diffusion of Innovations. Fifth Edition New York: Free Press. Sabo, E. (2006). Participatory Assessment of the Impact of Women in Agriculture Programme of Borno State, Nigeria, Journal of Tropical Agriculture, Department of Agricultural Economic and Extension, Adamawa State University, Mubi.

Röling, N. and P.G.H. Engel. (1990). Worldwide institutional evolution and forces for change. In Rivera, W. & Gustafson D. J. (Ed.) The Development of the Concept of Agricultural Knowledge Information Systems (AKIS): Implications for Extension. The Netherlands: Elsevier.

Saka, J.O., Okoruwa, V.O., Lawal, B.O. and Ajijola, S. (2005): Adoption of improved Rice Varieties Among Small-holder Farmers in South-Western Nigeria. *World, journal of Agricultural sciences, ISSN 1817-3047 Idosa publication 2005*.

Sandra, A.O & S. B Ago (1996). Longman, UK First Edition,

Simon, R. and Chall J. (2008): The Role of Cooperatives in Bresty South District Ife Psychologies. Szreter, S. and Woodcock, M (2004).Health by association? Social capital, Social theory and the political economy of public health. *International Journal of Epidemiology*.

Singh, B.R & Babaji G. A (1990). Characteristics of the soil in Dundaye District. 2. The Fadama Soils of University Farm, Nigeria Journal of Basic and Applied sciences 4, 29-30

State Extension leaders Network (SELN) (2006) Enabling change in Rural and Regional Austria: The role of extension in achieving sustainable and productive future online resource: www.seln.org.au.

Stone, Diane (2004) Transfer agents and global networks in the transnationalization of policy "Journal of European Public Policy".

Sultana P and Thompson P. (2003) methods for consensus building community based fisheries management in Bangladesh and the Mekong. CAPRI Working paper 30. Washington D.C International food policy research institute. http://www.capri.egiar.org/pdf/capriwpp30.pdf.

Torimiro, D.O, Kolawole, D.O., Okorie, V.O., 2007, In-school farm youth and ICT usage: A gender analysis of Nigeria's Yoruba communities. Journal of youth studie, Vol 2, (1)

Umebali, E.E. (2004). Agribusiness and Financial Analysis. Lagos: Computer Edge Publishers.

Unamma R.P.A., Onwudike A.C., Uwegbute A.C., Edeoga H.O. and Nwosu A.C. (2004) Linkage strategy for sustainable Agriculture in Nigeria: research – Extension –Farmer – Input Linkage System (REFILS) Michael Okpara University of Agriculture Umudike. Publication (sponsored by U.S.A. Embassy Abuja Nigeria).

UNICEF, (2000).Nigeria and the Convention on the Rights of the Child.A Workbook for Nigerian Junior Secondary School Students. UNICEF Country Office Lagos, Nigeria.

Uwaka C.T. (2005) Extension Teaching method in Nwachukwu I. and Onuekwusi G. Agricultural Extension and Rural Sociology. Snaap Press Oak. Hamton.

Valente T and Rogers E. (2009) "The origins and Development of the diffusion of innovations paradigm as an Example of Scientific Growth". Science Communication.

Van den Ban, A. W., and H. S. Hawkins. (1996). Agricultural Extension, 2nd ed. Oxford: Blackwell.

Van dem Ban, A. & Hawkin H. (1988). Agricultural Extension Bath Press, Avon Great Britian.

Wanyania F.O., Develtene, P. &Pollet, I. (2008).Encountering the Washington, D.C.

Wejnert B. (2002) "Integrating models of diffusion of innovation a conceptual framework *Annual Review of Sociology".*

Wiklund, Johan & Shepherd Dean A. (2003). Knowledge-Based Resources, Entrepreneurial Orientation, and the Performance of Small and Medium-Sized Business. Strategic Management Journal 24(13):1307 - 1314 DOI: 10.1002/smj.360

Wilson J. (2002) scientific uncertainty complex systems and the design of common pool resources. In the drama of the common. Washington DE: National Academy Press.

Woolcock, M. &Nanayan, D. (2002). Social Capital: Implications for Development Theory, Research and Policy. World Bank Research Observations.

World Bank (1996). World Development Report 1996 : From Plan to Market. New York: Oxford University Press. © World Bank. https://openknowledge.worldbank.org/handle/10986/5979 License: CC BY 3.0 IGO.

World Bank (2001), Agricultural Development Project in Nigeria–Operations Evaluation Development. The World Bank Group.

World Bank (2003) Second National FADAMA Development Programme Implementation Manual.

Zeller, Manfred (2000). Determinants Of Credit Rationing: A Study Of Informal Lenders And Formal Credit Groups In Madagascar. World Development 22(12):1895-1907 DOI: 10.1016/0305-750X(94)90181-3

Questionnaire

Dept. of Cooperative Economics and Management
Nnamdi Azikiwe University, Awka,
Anambra State.
7th September, 2017.

Dear Respondent,

QUESTIONNAIRE

I am a doctoral researcher of the above named department, carrying out a study on DETERMINANTS OF ADOPTION OF IMPROVED AGRICULTURAL TECHNOLOGIES AMONG FADAMA RICE FARMERS COOPERATIVE SOCIETIES IN ENUGU STATE. This questionnaire is designed to obtain information for a research study. I solicit your support to provide adequate and accurate information as all information provided will be used for academic purpose and treated with confidentiality.

Thanks.

Ogbodo Ikechukwu Henry
PhD Student/Researcher

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

Please provide information or tick [√] where appropriate

1. Name of your cooperative .....

2. Membership duration

(a) Less than 3years

(b) 4-7 years

(c) 8-12years

(d) Above 12 years

3. Gender of respondent:

( ) Female.....

( ) Male.....

4. Age of respondent: 0-30 ( ), 31-45 ( ), 46-60( ), 61+ Years

5. Marital status: single ( ) Married ( ) Divorced ( ) Widowed ( )

6. Educational level: No formal education ( ) Adult education ( ) Primary education ( ) Secondary education ( ) Tertiary education ( )

7. Location of the farm:

a. Urban areas

b. Semi urban

c. Rural areas

d. Remote and difficult to access rural areas

8. Household size: 1-3 ( ), 4-6 ( ), 7-9 ( ), 10-12 ( ) 13 and above ( )

9. Total area of farmland owned in hectares: < 2.5( ), 2.5-4.9 ( ), 5.0 ( )

10. Agricultural experience level of farmer: 0-10 ( ), 11-20 ( ), 21-30 ( ), 31-40 ( ) 41 and above

11. Farmer' contact with extension agents 0-5 ( ), 6-10 ( ), 11-15 (), 16-20 ( )

12. Annual farm income

a. Less than 200,000

b. 200,001 – 500,000

c. 500,001-1,000,000

d. 1million – 5 million

e. Above 5million.

13. Annual rice output

a. Less than 1 ton

b.1-5 tons

c. 5-10tons

d. Above 10tons

Section B

16. Indicate the extent to which you have adopted the following agricultural technologies

	Very High	High	Moderate	Low	Very Low
Spacing					
Varieties					
Line planting					
Fertilizer application					
Lime application					

17. Indicate the extent to which the following factors influence adoption of agricultural technologies

	Very High	High	Moderate	Low	Very Low
Sex					
education					
Farm size					
Annual income					
Household size					
No of contact with extension					
Duration in cooperative					
Location of the farm					
Farming technology in use					
Motive for farming					
Parent/guardian occupation					
Source of information/sensitization					
Membership status in farm association					
No of trainings/seminars attended					
Source of fund for farming					
Value of productive asset					
Availability of success stories					
Attitude of extension workers					

18. Indicate your agreement on the effect of cooperative to adoption of improved agricultural technologies

	SA	A	N	D	SD
Awareness creation					
Sharing of ideas					
Mitigating hindrances /objections					
Provision of guarantee					

Bargaining for better cost of adoption					
Convincing laggards and late adopters					
Peer pressure towards adoption					
Cheaper platform to achieve mechanization/modernization					
Access to reliable experts					
Provision of accessible experiment/practical					
Platform for accessing adoption support services					
Access to government /donor aids and assistance					

19. To what extent has adoption of innovation affected production positively?

	Very High	High	Moderate	Low	Very Low
Increased productivity					
Increased output					
Increased income					
Better land management					
Efficiency in use of resources					
Better climatic management					
Increase in mechanization					
Increased access to foreign market					
Increased industrialization					
Increased interest in agriculture					
Commercialization of agricultural activities					
Increased funding opportunities					

20. To what extent has adoption of innovation affected production negatively?

	Very High	High	Moderate	Low	Very Low
Health implication of the produce					
Erosion of cultural values					
Exploitation and excessive profit maximization					
Displacement of labourers					
Exploitation of land and other resources					
Creation of bureaucracy/inefficiency					
Increasing need for capital/funding					
Crowding out of subsistence producer					
Affect religious and personal beliefs					
Increases climatic imbalance					
Unnecessary Increase in maintenance					

cost					
Increase in poverty of vulnerable farmers					

21. State your agreement on the extent to which these hindrances hinder adoption of improved technologies

	SA	A	N	D	SD
Inadequate extension agents					
Market value of rice					
Illiteracy					
Individualism among farmers					
Poor access to information					
Cost of adoption					
Adverse effect of adoption					
Government policies					
Societal attitude to innovations					
Volume of production					
Low awareness					
Tasking nature of adopting innovations					
Socio-cultural reasons					
Weak media channel					