FACTORS AFFECTING ADOPTION OF RECOMMENDED CERTIFIED RICE SEED TECHNOLOGY BY FARMERS IN FOUR LOCAL GOVERNMENT AREAS OF KADUNA STATE, NIGERIA.

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DECLARATION

I hereby declare that this thesis titled **"Factors Affecting Adoption of Recommended Certified Rice Seed Technology by Farmers in Four Local Government Areas of Kaduna State, Nigeria"** has been written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma at any institution. All borrowed ideas have been acknowledged in the text and a list of references provided.

_____ _____

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CERTIFICATION

This thesis titled **"Factors Affecting Adoption of Recommended Certified Rice Seed Technology by Farmers in Four Local Government Areas of Kaduna State, Nigeria"** by **Jolly Nairi MA'AJI** meets the regulation governing the award of the Degree of Master of Science, Agricultural Extension and Rural Sociology of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to the glory of God for the grace He has given me to complete this work.

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My special gratitude and thanks is given to the Almighty God for his guidance and protection all through the period of my study, I give him all the praise for making it possible to complete the program.

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ABSTRACT

This study examined the factors that influenced the adoption of recommended certified rice seed technology in four purposively selected rice producing Local Government Areas namely Chikun, Giwa, Lere and Zangon Kataf of Kaduna State. The specific objectives were to, describe the socio-economic characteristics of farmers in the study area, identify the sources of the recommended certified rice seeds and other farm inputs, describe the extent of adoption of the recommended certified rice seed technology, determine the socioeconomic, institutional and technological factors that influenced the adoption of the recommended certified rice seed technology, determine the effect of adoption on farmers' yield, income and level of living, identify the constraints faced by farmers in the adoption of the recommended certified rice seed technology. Primary data were collected using structured questionnaire from 192 randomly selected contact farmers in four selected rice producing Local Government Areas of Kaduna State. Descriptive and inferential statistics were used to analyze the data. The study shows that most of the farmers were in the age category of 40-49 years and 86% of them had formal education. The average farm size cultivated by farmers was 3.90 hectares while 80% of farm lands owned by the farmers were acquired through inheritance. Farmers' major sources of recommended certified rice seeds and other farm inputs were from dealers and government. Extension visits was 86%. Only 28% of farmers were able to access credit. The average extent of adoption of the recommended agronomic practices was 57%.The recommended agronomic practices least adopted were the use of the recommended fertilizers and agrochemicals probably due to their expensiveness. The variables that significantly influenced the adoption of the certified rice seed technology at 5% level of significance were, years of formal schooling, membership of social groups and amount of credit accessed. Those variables that influenced the adoption of the certified rice seed technology at 1% level of significance were extension visits and trialability. The F-value was 2.18 and was significant at 5% level which implied that the independent variables included in the model contributed in explaining the variations in the adoption of the certified rice seed technology. The effect of adoption was that farmers' mean yields, income and level of living after adoption were higher than those before adoption implying that changes have occurred through increase in the yield, income and level of living of the farmers as a result of adoption of the certified rice seed technology. Farmers were constrained by limited access to credit, irregular supply of recommended seeds and other farm inputs as well as expensiveness of fertilizers and agrochemicals. It is recommended that government and the private sector should partner to provide adequate infrastructure, delivery and supportive services to farming communities in order to promote and sustain technology adoption. It is recommended that government should offer incentives such as relaxing tarrifs on imports and levies on agricultural input processing equipment, manufacturing, blending and credit facilities to the private sector to enable them manufacture, blend and supply farm inputs to the majority of small scale farmers at affordable prices

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The development of new agricultural technologies, their wide spread diffusion and adoption has created a remarkable shift in agricultural practices leading to rapid agricultural productivity, the division of labor and specialization in agriculture which were absent in the hunter-gatherer cultures of early human history. Within the overriding objective of increasing aggregate agricultural output in the third world countries, a primary goal of agricultural development has been to improve the welfare of rural families through enhancing productivity of small farms and promoting equitable access to resources, markets and technical assistance (Food and Agriculture Organization, 1986).

Increasing agricultural productivity using recommended agricultural technologies has been identified as a precondition for achieving food security (Langyintuo *et al.* 2000). With the emphasis in recent years on the development of small farm agriculture, many development experts and agricultural research scientists remained frustrated by the limited success of their projects as small scale farmers frequently reject or partially adopt recommended technologies. This occurs despite the technology's demonstrated higher levels of productivity in experimental plots, its calculated profitability for the farmer and its beneficial contribution to the larger society (Food and Agriculture Organization, 1986).

The problem of limited adoption of introduced technologies can best be thought of as the technology application gap which diverse explanations have been advanced that the technology is good while the farmer is at fault, others attribute this to farmers' attitudinal constraints such as their innate conservatism, ignorance, resistance to change, inadequate support systems, agro-climatic conditions and many other reasons (Food and Agriculture Organization, *1986;* Perin and Winkelman, 1976*).*

*Ni*geria, once an exporter of surplus food has now lost its way in response to the oil bonanza which dates from the 1980's. Comfortable to its new wealth, the government allowed investment in agriculture to decline (One World Guide, 2011). Nigeria has instead become one of the world's largest importer of food especially rice and wheat. According *to* Olaf *et al.* (2003), Nigeria is the second largest importer of rice in the World, buying at least two million metric tons per year from exporting countries like China and Thailand, yet Nigeria's fertile low and rich agro-climatic conditions could easily produce rice to feed the entire country and generate surplus for export. Similarly, according to Akinwumi (2012), the current food imports in Nigeria in 2011 stands at ₦1.3 trillion with rice imports standing at ₦356 billion. Abubakar (2010) reported that by 2006 Nigeria ranked 20th on the global hunger index in which average yields of major staple crops remained far below most other developing countries. Although food security commanded the highest priority in both the past and current administrations, achieving national food security continued to be a challenge as over 90 million Nigerians are food insecure out of which 70% live in rural areas (Abubakar, 2010).

Rice is a very important food globally. It is consumed by over 4.8 billion people in 176 countries. In Nigeria, rice is a staple food in the diet of 120 million people (Daramola,2005) and its production occurs in all agro-ecological zones with an annual

production of 3 million metric tons having an average yield of 1.8 metric tons per hectare (Daramola,2005). Nigeria's annual demand for rice is 5 million metric tons while its annual production level is 3 million metric tons. The deficit of 2 million metric tons annually has to be filled with imported rice (Qlaf *et al.* 2003). According to Olaf *et al.* (2003), rice is produced predominantly by small scale farmers. In Kaduna State, rice production is predominantly a rural economic activity done mainly under rain fed upland and lowland production. Sole cropping is dominant in rain fed lowland rice while intercropping is a common feature in rain fed upland rice production. Nigeria's annual rice production is not sufficient to match its annual consumption requirements. According to Daramola (2005), the low growth rate of paddy rice production can be attributed to a combination of factors namely unimproved seed varieties, poor agronomic and post harvest handling practices therefore increased production would have to come from increased yields.

According to Ifeanyi *(2013)*, if the rice varieties are released by research, there are technologies in place for these varieties to manifest fully but where farmers are not using these technologies fully, their efforts will not yield the desired results. Nigerian agriculture is dominated by poor resource holder farmers (small scale farmers) from which over 90% of agricultural production comes. Over 60% of the country's population earn their living from small scale farming and over 90% of Nigeria's total agricultural production is accounted for by these small scale farmers (Ogungbile and Olukosi, 1991). According to Ogungbile and Olukosi (1991), the small scale farmer is a peasant farmer, he produces for subsistence to provide for his family before considering the sale of the surplus to the market; he is constrained by production resources namely land, labour and capital. He depends mostly on family labor, seeds are mainly self

supplied, he lacks collateral to secure loans, his level of technology is biased towards low-risk production traditional techniques and has low income. He may not have access to land and mainly use traditional farm tools. It is important to increase the small scale farmers' farm yields per plant, per unit area of land and per unit time through adoption of recommended agricultural technologies which hold the key not only to addressing food insecurity but also to develop the entire Nigerian agricultural sub-sectors as modern agricultural methods have been proved to be able to increase food production (Pretty *et al.* 2002).

In Kaduna State, over 90 percent of the population engaged in agricultural production are small scale farmers who produce the bulk of the food we eat, use in industries and for export. It is from these small scale farmers that the village extension agents select majority of their contact farmers. According to Daniel and Michael *(1984)*, "Contact farmers are a proportionate representative of farmers in a group whom the village level extension worker focuses on each fortnightly visit, advising and teaching them recommended farm technologies, convincing them to adopt the recommendations and also bring farmers' problems back to research." It is expected that these contact farmers will in turn explain the recommended technologies to other farmers thereby help in their diffusion and adoption in the social system.

Among agricultural inputs, seed is recognized to have the greatest ability of increasing on-farm productivity since it determines the upper limit of crop yields (Mohammed, 2004). A seed is a unit of production which carries inherent genetic characteristics from generation to generation. It can best be described as a plant in its resting stage. A seed serves as the foundation upon which the superstructure of crop production is built, if the

foundation is weak, then it cannot support the structure (Ogunbiade, 1991). It is therefore necessary to find mechanisms that guarantee farmers' access to high yielding certified seed varieties. All seeds grown by farmers can be classified into certified and non-certified seeds. Certified seeds are those that have been produced to standards set down by the government certification agency in quality assurance schemes. It can be identified by an official blue certified seed tag (of the National Agricultural Seed Council in Nigeria) attached to the container. In Nigeria, it is the mandate of the National Agricultural Seed Council to oversee the development and regulation of the nation's seed industry. Non-certified seed is referred to as farmer saved seeds or home grown seed (Blount *et al.* 2009).

The purpose of certification is to maintain and make available to the public high quality seeds and propagating materials of superior crop varieties so grown and distributed as to ensure genetic identity, purity and reasonable standards of seed quality and conditions. Only those varieties that are approved by the government research agencies and accepted by the certification agency are eligible for certification, (Allard, 1960; Blount *et al.*2009). According to Norman and Christopher (2004), certified seeds can achieve significant productivity impact if systematic changes are made through the infusion of good crop management practices. In spite of the efforts by the Federal and State Governments, National Agricultural Research Institutes, Agricultural Extension Services and Private Seed Companies towards the development of improved crop varieties, their production, distribution, and promotion for adoption, many farmers are still not using certified seeds. Farmers are therefore not exploiting the enormous potential economic benefits from these certified seeds (Witcombe *et al.*2000). Certified seeds, being an innovation have to be combined with other recommended agronomic

practices such as seed treatment, planting dates, plant spacing, fertilizer application, weed control, pests and diseases control and timely harvest into a technology package before the crop's potential output is realized. Ezeilo (1979) in his findings opined that the adoption of new technology is best promoted by means of an integrated package of farm support measures to overcome constraints due to the new technology. The technology package has to gain an overwhelming popularization among its potential users through a diffusion sub- system. The diffusion sub-system includes extension workers, mass media, National Agricultural Extension and Research Liason Services, private seed companies, farm input agents and farmers. They create awareness and provide seed related information on yield potential, availability and accessibility.

1.2 Problem Statement

The development of high yield recommended rice seed varieties, their production, distribution, diffusion and adoption are of immense importance. Though rice seed demand varies significantly among farmers due to diversity in farm systems, many of them still plant seeds obtained from non-certified sources. The production of rice should be increased to ensure food and income security as well as minimize poverty in the state.

There is the need to explore more effective promotion strategies for recommended certified rice seed technologies so that their adoption can be increased to meet the food security needs of the study area.

It is expected that with the increase in the number of Agricultural Research Institutes in Nigeria and their zoning according to agro-ecological conditions with the mandate to breed and develop new crop varieties suitable for specific agro-ecological areas, farmers

will be better exposed to the utilization of more research output unlike before when horizontal crop recommendations were made for Northern States irrespective of their different agro-climatic conditions.

Kaduna state is blessed with quite a number of National Agricultural Research Institutes and Colleges of Agriculture, it is also blessed with the headquarters of the North West Zone of the National Agricultural Seed Council where seed policies are implemented. It is also blessed with the country's major seed companies and registered seed growers mostly located in Zaria. The seed industries and registered growers are responsible for the multiplication of foundation seeds into certified seeds and their marketing. The Kaduna State Agricultural Development Project which came into being in 1984 is responsible for the Public sector agricultural extension services in addition to Non-Governmental Organizations like the Sasakawa Global 200 which is rigorously into extension activities. A number of other agricultural and rural development programmes and projects such as Fadama 3, Community Based Agricultural and Rural Development Project, Commercial Agricultural Project, Agricultural Enhancement Project and National Programme on Food Security are currently being implemented in the entire state aimed at raising farmers' level of living through adoption of agricultural innovations. In addition to the above projects, Information Communication Technology is expected to have tremendously raised the awareness and knowledge level of farmers about agricultural innovations available in the state for adoption.

Despite the above structures and efforts, Hiroyuki *et al*. (2010) found that seed recycling for the next production season is dominant among farmers as some farmers plant certified rice seeds in the first year and then use farmer saved seeds in subsequent

years while others do not use certified seeds at all. Therefore there still exist challenges in raising farmers' adoption of recommended certified rice seed technology. It is in view of the above that there is the need to find out why farmers are not adopting certified rice seed technology. The following research questions were addressed;

i What are the socio-economic characteristics of rice farmers in the study area?

ii What are the sources of the certified rice seeds and other farm inputs?

iii. What is the extent of adoption of the recommended certified rice seed technology?

iv. What are the factors that influenced the adoption of the recommended certified rice seed technology?

v. What is the effect of adoption on farmers' yield, income and level of living?

vi What are the constraints faced by farmers in the adoption of the recommended certified rice seed technology?

1.3 Objectives of the Study

The broad objective of this study was to evaluate the factors affecting affecting the adoption of recommended certified rice seed technology.

The specific objectives were to;

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

ii identify the sources of the recommended certified rice seeds and other farm inputs.

iii. describe the extent of adoption of the recommended certified rice seed technology.

iv. determine the socioeconomic, institutional and technological factors that influenced the adoption of the recommended certified rice seed technology.

v. . determine the effect of adoption on farmers' yield, income and level of living.

vi identify the constraints faced by farmers in the adoption of the recommended certified rice seed technology.

1.4 Justification of the Study

Despite the fact that small scale farmers in Kaduna State provide almost all the staple food consumed in the state, adoption of agricultural innovations is limited by unfavorable socio-economic, cultural and institutional conditions. They are however capable of transforming traditional agriculture if they adopt feasible technologies. As the seed is the foundation upon which the super structure of crop production is built, food security cannot be achieved without adoption of recommended certified seed technologies by the majority of small scale farmers who produce over 90% of the food consumed, utilize in industries and export. The Government's recent increase in import duty of imported rice should imply more favorable returns to rice production thus making local rice production more economically attractive. This study would provide useful information on the adoption of certified rice seeds which can be used for the formulation of appropriate policies that would increase rice production thereby reduce its importation..

1.5 Hypothesis

Ho: There is no significant relationship between the socio-economic, institutional and technological variables of farmers and adoption of the recommended certified rice seed technology.

CHAPTER TWO

LITERATURE REVIEW

2.1 General Features of Diffusion of Innovations

Rogers (1995) traced the study of diffusion of innovations back to Gabriel Tarde in 1903 who attempted to explain why some innovations are adopted and spread throughout a society. However, the fundamental diffusion paradigm for diffusion of innovations is credited to investigations of the diffusion of hybrid seed corn among Iowa farmers at Iowa State University by Bryce Ryan and Neil, C. Cross in 1943. As new agricultural technologies appeared, rural sociologists focused their research on human problems among farmers because in spite of these technological developments some farmers ignored or resisted the innovations. The process of adopting innovations have been studied for over 40 years and one of the most popular adoption models is described by Rogers in his book, "Diffusion of innovations, 1962", which is widely being used as the theoretical frame work in the area of technology diffusion and adoption. This theory is concerned with the manner in which a new technological idea or technique migrates from creation to use. The technological innovation is communicated through particular channels, overtime among members of a social system.

Innovation, communication channels, overtime and a social system form the four key elements in the diffusion of innovations (Rogers, 2003). An innovation or technology according to Rogers (2003), is a design for instrumental action that reduces the uncertainty in the cause effect relationships involved in achieving the desired outcome. The technology is composed of two parts, the hardware (material or physical object) and software (information base). He further described innovation as an idea, practice or

project that is perceived as new by an individual or other unit of adoption. Channels of communication involves the media and interpersonal communications which provided information and influences opinion and judgments (Rogers and Singhal, 1996). Communication, according to Rogers (2003), is a process in which participants create and share information with one another in order to reach a mutual understanding. According to Rogers (1995), there are four key elements of diffusion of innovation (the innovation, communication channels, overtime and social system). Sender can be inventors or opinion leader; message can be the idea, technology, information, practice or products; channels can be interpersonal or mass communication; receivers can be members of a social system and effect can be an individual's adoption or social change.

Time variable is a very important factor involved in the innovation decision process, innovativeness and innovation rate of adoption (Rogers, 1995). Five different types of adopters based on their degrees of relationship to each other in the diffusion process according to their innovativeness as identified by Rogers (1995) are: innovators 2.5%, early' adopters 13.5%, early majority 34% late majority 34% and Laggards 16%. The adopter categories as defined by Rogers (2003) are a classification of members of a social system on the basis of their innovativeness. The social system is a set of interrelated units engaged in joint problem solving to accomplish a common goal. The innovation decision process is an information seeking and processing process where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation. Nwanko *et al.* (2009) argued that a new technology presents higher risks than old ones whose outcome are relatively known by users. Small farmers will evaluate any introduced technology (by trial on a small scale) to avoid risks. Information acquisition is a critical stage in the adoption process (Efthalia and Dimitris, 2002). The

innovation decision process involves five steps namely: knowledge, persuasion, decision, implementation and confirmation stages which typically follow each other in a time ordered manner (Rogers, 2003).

In the knowledge stage, the individual learns about the existence of the innovation and therefore seeks for more information. The awareness stage represents the knowledge of the innovation's existence which can motivate the individual to learn more about the innovation and how to use it correctly. In persuasion, when an individual develops a favorable or unfavorable attitude, negative or positive attitude towards the innovation, she /he forms opinions and beliefs about the innovation and subject it to evaluation. The decision stage engages an individual in activities that lead to choice to adopt or not to adopt or reject the innovation while adoption refers to the full use of an innovation as the best course of action available (Rogers, 2003). The implementation stage involves putting the innovation into practice. The final stage of innovation decision process is the confirmation state in which an individual evaluates the results of an innovation decision already made and now looks for support for his/her decision, here the decision can be reversed if the individual is exposed to conflicting messages about the innovation (Rogers, 2003). Attitude is crucial as later adoption or discontinuance may happen depending on the support for adoption or attitude of the individual. Attributes of innovations that help decrease uncertainty are relative advantage, compatibility, complexity, trialability and observability.

An innovation is of relative advantage when it is perceived as being better than the idea it intends to superceed. It could be economic profitability, low initial cost, low perceived risks, time saving or decreased discomfort. When an innovation is

compatible, it is perceived by the users as consistent with existing values, past experience and needs. Complexity is the degree to which an innovation is relatively difficult to understand and use. An innovation must be simple and having clarity. Complicated innovations lead to difficulty in application. Trialabilitv is the degree to which an innovation can be tried or experimented. Farmers often show high levels of adoption of selective components of an innovation rather than whole package adoption. Ryan and Subramayan (1975) showed that innovations that can be tried in bits or parts will generally be more acceptable than indivisible ones. Improved technologies could be broken down into clusters of practices in accordance with the farmer's resources and experience with the technology (Mann, 1978). Observability is the degree to which the result of an innovation is visible to farmers. Innovation results must be easily observed, seen and communicated to farmers.

The scope and application of diffusion research has focused on five elements namely, the characteristics of an innovation which may influence adoption, the decision making process that occurs when individuals consider adoption of an innovation, the characteristics of individuals that make them likely to adopt an innovation, the consequences for individuals and society for adopting an innovation.

2.2. Empirical Studies on the Socio-Economic Characteristics of Farmers

According to Ruttan (1977) and Gershon *et al*. (1981),socio-economic, institutional and technological factors systematically summarizes the vast amount of empirical literature on adoption. Atala *et al*. (1992), in their studies re-affirmed that socio-economic variables and institutional factors on farmers' adoption of farm innovations is generally significant. Food and Agriculture Organization (1986) in its studies reported that the

socio- economic organization of the farm system merits attention as small farmers operate a particular set of socio-economic conditions which in many cases distinguish them from capitalist enterprise as the small scale farming system is embedded within the economy of the house hold goals, attitudes, management strategies, decision making and constraints. In this empirical study review, farmers' socio-economic characteristics, institutional and technological variables include: age, years of formal schooling, farm size, sources of certified seeds, frequency of extension contact, membership of co-operative society or farmers association, amount of credit accessed and technology.

2.2.1 Age

Age can have different effects on the rate of adoption depending on the characteristics of the innovation. Lionberger (1960), described farmers who adopted an innovation early as being younger. In the studies conducted by Voh (1979); Atala (1980); Osuji (1983); Akinola (1983) and Atala *et al.* (1992), age was found to have influence on adoption on which they reported that adopters were younger than non adopters. However, Paul *et al*. (2003) in their studies found that age of a farmer correlates negatively with the probability of being an early innovator but younger farmers had a higher rate of adoption than conservative old farmers. The apriori expectation was that farmers' age would influence adoption of the recommended certified rice seed technology.

2.2.2 Years of Formal schooling

Several studies conducted by Rogers (1962); Osuji (1983); Akinola (1983); Sanni (1991); Omokore (1986) and Kudi *et al*. (2010) found that the farmer's years of formal schooling was positively related to adoption and that innovators and progressive farmers

tend to be more educated than non progressive ones. Rogers (1962) described early adopters as having more years of schooling thus indicating that as educational status increases, adoption level also increases among farmers. It is expected that more years of schooling of farmers would significantly influence adoption of the recommended certified rice seed technology.

2.2.3. Farm Size

Farm size has been found to have different effects on adoption depending on innovation characteristics and institutional settings. Atala (1984) and Atala *et al.* (1992) found that upland farm size was related to adoption. Similarly, Perrin and Winkelman (1976) concluded in their studies that farm size is not particularly a significant variable influencing adoption. Hence farm size can therefore have different effects on the rate of adoption depending on the innovation characteristics and institutional settings such as human capital, credit constraints, tenure arrangement, fixed adoption cost and labour requirements (Gershon *et al*. 1981). The apriori expectation is that farm size would influence adoption of the recommended certified rice seed technology

2.2.4 Amount of credit accessed

Diverse empirical findings have evolved from the role of credit in financing adoption of agricultural technologies. Atala *et al*. (1992) in their studies found that credit was not a significant influencer of gross farm output even though it was positively and significantly correlated with adoption of farm innovations probably due to misuse of credit. According to Osuji (1983), whenever farmers are provided with credit facilities (in cash or kind or both), their adoption rate is expected to be high, hence farmers with dependable income are more likely to adopt new practices. Similarly, Akinola (1983)

found that access to an institutional variable like farm credit affects adoption of farm recommendations and agricultural productivity in some ways. Lipton (1976) also found that access to capital is a factor affecting differential rates of adoption. Kudi *et al*. (2010) in their studies reported that farmers will adopt new innovations if they have access to credit which would enable them to purchase inputs and pay for labor required. With these empirical findings, it is expected that amount of credit accessed would stimulate and increase farmers' intensity of adoption of the recommended certified rice seed technology.

2.2.5 The technology characteristics

Researchers have over the years paid little attention to analyzing how the properties of their innovations affect their acceptance or rate of adoption. Understanding this will be of great value as both researchers and extension workers can often predict the reaction of their clients and perhaps modify some of the observed unfavorable characteristics.

A key part of the adoption process is identifying the criteria used in decision making. According to Rogers (1995), the attributes of an innovation helps decrease or increase uncertainty, influences the farmer's decision making process and adoption. Rogers (1962) described the attributes or characteristics of an innovation to include: relative advantage, compatibility, complexity, trialability and observability (visibility). A new innovation has to have a relative advantage over the old practice (Rogers and Shoemaker, 1971) and it has to be consistent with the existing cultural patterns. Other attributes include innovations that are divisible, low cost and profitable. Innovations that are also congruent with previous innovations are adopted quickly. Kudi *et al.* (2010) in their studies found that yield is a direct measure of seed performance and a crop variety that has high yield stands to be adopted since the yield will raise output and gross

income. Most empirical studies concentrate efforts on effect of farmer characteristics on adoption but say little on the influence of technology characteristics (Batz *et al.* 1999). Rarely is a technology for the targeted small farmer questioned (Food and Agriculture Organization 1986). According to Food and Agriculture Organization (1986), many improved technologies are simply inappropriate for the conditions of small scale farm systems probably as a result of inadequate understanding of the socio-economic organization and goals of small scale farmers. Garforth and Richard (1996) found that the relevance and appropriateness of the information and technology itself is a most commonly cited factor influencing research output which were tailored to users' needs. It is expected that technology characteristics would increase adoption of the recommended certified rice seed technology among farmers.

2.3 Empirical Studies on Sources of Certified Seeds and other Farm Inputs

Seed availability is critical including crop varieties that have the characteristics required for local climatic and soil conditions to meet the needs and wishes of farmers (Consultative Group for International Agricultural Research, 1998). In their studies, Kudi *et al*. (2010) identified one new maize variety, DMRESR-Y as the most common improved variety in the study area whose source was mainly through extension agents and other farmers. Similarly Institute for Agricultural Research (2001), in their studies found that the Agricultural Development Programme (extension agents) remained the main source of contact of farmers but however maintained that sources of information on improved agricultural technologies have been the Agricultural Development Programmes, farmers, agricultural input marketers and Non-Governmental Organizations in the case of cowpea in Northern Nigeria. Consultative Group for International Agricultural Research (1998) in its studies on adoption of new sorghum

varieties attributed cultivar awareness among farmers mainly to research staff, agents of brewery companies and farmer to farmer contact as many villages do not have extension agents. The apriori expectation is that sources of seeds and other farm inputs would influence adoption of the recommended certified rice seed technology.

2.4 Empirical Studies on extent of Adoption of Recommended Technologies

The extent of adoption of an innovation as defined by The Free English Dictionary (2002) is "the degree, scope, magnitude to which an innovation is adopted." In words, the degree, scope, magnitude of the continued use of a technology. Tushar *et al.* (2013) in their study on the extent of adoption of recommended sweet peppers technology reported that the use of recommended seeds was the most adopted agronomic practice. Mbanaso *et al*. (2012) in their study on the extent of adoption of recommended sweet patato technology found that majority of the farmers have adopted all the recommended practices except plant spacing. Obeta and Nwagbo (1991) in their studies on the adoption of improved cassava technology package found that the components (agronomic practices) of the technology package were adopted partially. Similarly, Njoku (1991) in his studies of improved oil palm production technologies found that 75% of small scale farmers have adopted 3-4 of the six technologies introduced.

2.5 Factors Influencing Adoption of Recommended Technologies

Empirical studies on factors influencing the adoption of certified seeds by Consultative Group for International Agricultural Research (1998); Institute for Agricultural Research (2001); Omonrice (2008); Hiroyuki *et al*. (2010) and Kudi *et al*. (2010) found that the following factors; age, level of farmers education, farm size, extension contact, membership of farmers associations, amount of credit accessed and the technology itself

influenced adoption of certified seed technologies. Adoption should be backed by appropriate goals, monitoring, feedback as well as directing where extension efforts should be directed in order to advance the programme.

2.6 Effects of Adoption of Recommended Technologies

Yield is a direct measure of seed performance. In the studies on the adoption of new maize varieties, Kudi *et al*. (2010), in their study on adoption of improved maize varieties found that the yield was positive and highly significant at 1% level of probability thus signifying that increase in yield will lead to increase in adoption of new maize varieties. Studies conducted by Michael *et al*. (2001) found that certified wheat seed had a yield advantage of 3 bushels per acre over farmer saved seeds resulting in a $6.75 (₦1,046.25) per acre return over the cost of the certified seed thus resulting in increased income to the farmer. It also found out that the farmer saved seed had severe seed damage and varietal purity problems. This explained the yield advantage of certified seeds over non-certified seeds.

2.7 Constraints Faced by Farmers in the Adoption of Recommended Technologies

Obeta and Nwagbo (1991) found that adoption of innovations can be seriously hampered by poor distribution of technological inputs. Ifeanyi *et al.* (1990) also found that lack of access to certified seeds, farmers' limited knowledge about certified seeds and lack of sufficient funds to purchase the seeds are serious constraints. Certified seeds cost a little more than non certified seeds (Blount *et al*. 2009), therefore, expensive seeds could pose a constraint to majority of small scale farmers who are resource poor. Complicated strategies lead to difficulty in application by farmers (Omonrice, 2008), while Institute for Agricultural Research (2001), in its studies attributed unavailability of the seeds and adulteration as constraints to adoption. Consultative Group for

International Agricultural Research (1998) found that failure to provide continuous sources of supply of seeds and other inputs like fertilizers limits maintenance of innovations once adopted. According to Consultative Group for International Agricultural Research (1998), the agricultural sector in Nigeria has the highest poverty incidence (over 67%) among all other occupational groups therefore poverty rates of small scale farmers could pose a constraint to adoption. Innovations that are not affordable and profitable may not be widely adopted. Farmers also need assurance of markets for their farm produce including the knowledge of their value chain so as to promote adoption. Rogers (1976) found that the communication channels used in the adoption process can also be a constraint.

2.8 Theoretical Framework

The theoretical frame work used in this study is based on the theories of social change and the adoption and diffusion of innovation. Social change may be defined as the process by which alterations occur in the structure and function of a social system which may be planned or unplanned (Rogers, 1995). According to Rogers (1969), the processes of social change involves three steps namely; creation of new ideas, communication and spread of the new ideas and change occurring within the social system as a result of acceptance or rejection of the new ideas or practices. Planned change entails the direct human intervention in the shaping and direction of change towards some predefined goals (Ekong, 2003). Planned change is therefore the conscious deliberate and intended attempts in the modification in human attitudes and behavorial patterns as a result of education. Because of certain traditional beliefs, values or cultural practices, farmers are felt to be unconcerned with improvements, unwilling to take risks or unable to take advantage of existing opportunities to adopt

introduced technologies (Sofranko, 1984). Technological change requires behavorial change on the part of farmers. It is feared that the farmer's behaviorial change will not occur until values change and are replaced by more modern ones. Accordingly, the necessary ingredient to agricultural modernization is a general orientation of farmer's beliefs, values and behaviors through education, training in literacy, and exposure to information (Sofranko, 1984).

The adoption of certified seed technology is a planned change, a planned human intervention (directed social change) which can be more efficient and rational in explaining the personal socio-economic characteristics of the small scale farmers. The Adoption and Diffusion of innovation theory is the foundation of agricultural extension outreach which seeks to explain how innovations are taken up in a population. The theory seeks to explain how, why and at what rate new ideas spread through cultures. It involves information flows regarding innovations, options and adoption procedures and how farming households and farming communities in general adopt and benefit from improved agricultural innovations thereby enhancing their collective welfare as a consequence of individual farm level growth.

2.9 Conceptual Model

A model is a construction that shows the relationship existing among variables. These relationships are depicted schematically or mathematically (Asika, 2001). The theoretical model is meant for a broad system of explanations which is not founded so much on prior findings but largely on untested and unproved assumptions about social realities (Ekong, 2003). The model in this study posits that the socio-economic characteristics, institutional and technological variables of small scale farmers would

influence the adoption behavior of farmers on certified rice seed technology which would eventually lead to increase or decrease in their farm yield, income and level of living.

Socio-economic characteristics were: age, years of formal schooling and farm size. Institutional variables were: sources of certified seeds, frequency of extension contact, membership of a social groups or organizations and amount of credit accessed while the technological characteristics of the certified seeds were relative advantage, compatibility, complexity, trialability and divisibility.

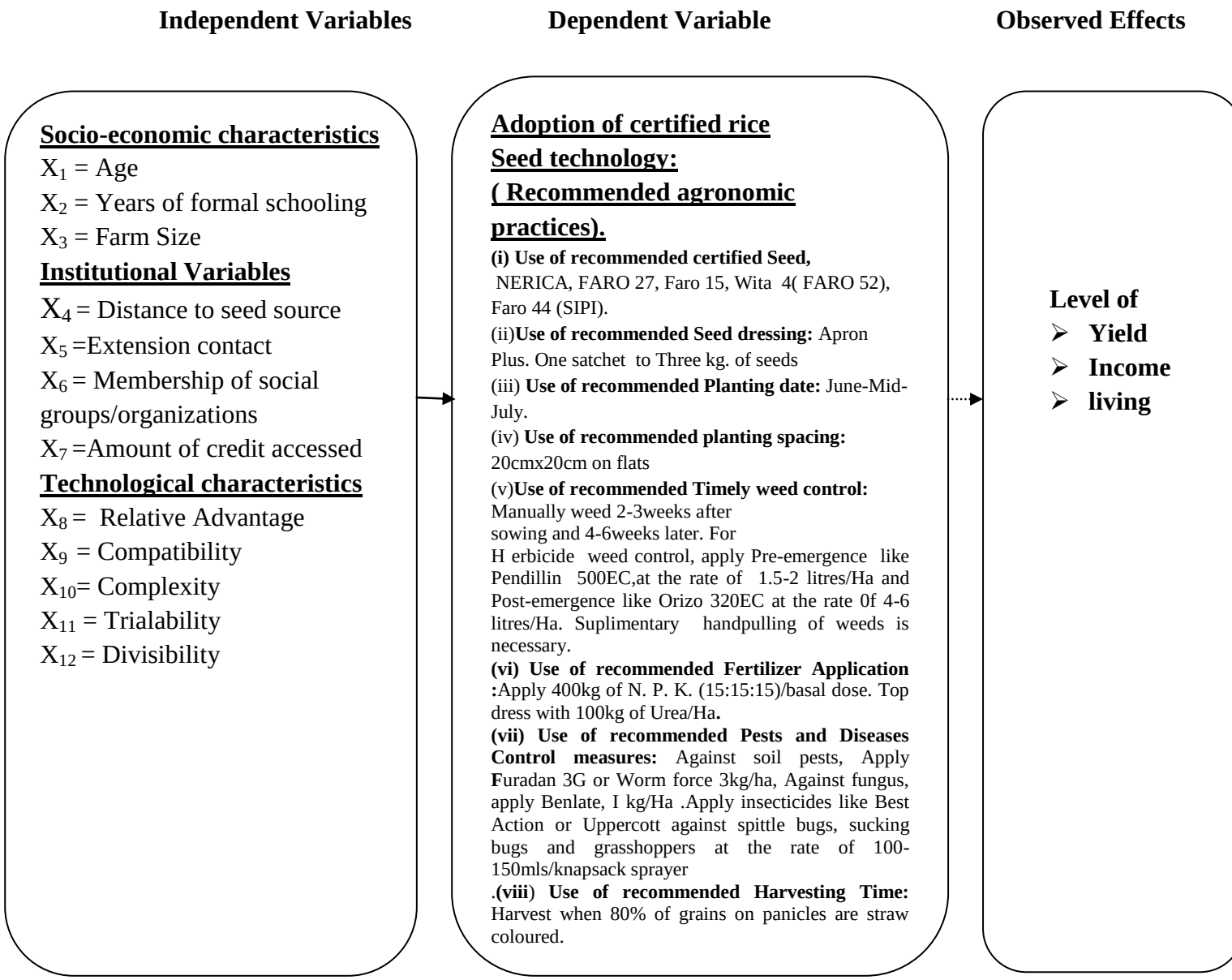


Fig. 2.1: Model of Farmers' socio-economic, institutional and technological characteristics that influenced the adoption of the recommended certified rice seed technology.

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

The study was conducted in eight rural communities namely Kujama, Janruwa, Saminaka, Yarkasuwa, Giwa, Kaya, Madakiya and Samaru Kataf. The communities are located in four Local Government Areas of Kaduna State (Kujama, and Janruwa in Chikun Local Government Area, Saminaka and Yarkasuwa in Lere Local Government Area, Giwa and Kaya in Giwa Local Government Area, Madakiya and Samaru Kataf in Zangon Kataf Local Government Area). Giwa and Kaya communities in Giwa Local Government Area are located in the Northern part of Kaduna State. Giwa Local Government Area is dominated by the Hausa and Fulani. It is bounded in the North by Katsina State, in the West by Birnin Gwari Local Government Area, in the South by Igabi Local Government Area, in the East by Sabon Gari and Zaria Local Government Areas. Saminaka and Yarkasuwa communities in Lere Local Government Area are located in the Eastern part of Kaduna State. Lere Local Government Area is bounded in the North by Bauchi and Kano States, in the West by Kubau and Kauru Local Government Areas and in the South by Plateau State. The Kurama and Hausa people are the major indigenous tribes in the communities.

Kujama and Janruwa communities in Chikun Local Government Area are located in the Southern part of Kaduna State. Chikun Local Government Area is bounded in the North by Kaduna South, Igabi and Birnin Gwari Local Government Areas, in the West by Niger State, in the South by Kachia Local Government Area and in the East by Kajuru Local Government Area. The major indigenous tribes in the communities are Gbagyi and Hausa. Madakiya and Samaru Kataf communities in Zangon Kataf Local

Government Area are located in the Southern part of the Kaduna State. Zangon Kataf Local Government Area is bounded in the North by Kachia and Kauru Local Government Areas, in the East by Kaura Local Government Area, in the South by Jama'a Local Government Area and in the West by Jaba Local Government Area. The major indigenous tribes are Atiyap and Bajju.

The communities are typical rural agricultural communities in terms of economic and social settings. There are farming households headed by House Hold Heads as the small scale farmers who cultivate food and cash crops using traditional farming tools. The population (in 2014) of Lere, Local Government Area is 426,066, Chikun Local Government Area is 473784, Giwa Local Government Area is 368,512 and Zangon Kataf Local Government Area is 407,036 by projection of the 2006 census figures on an annual growth rate of 3.2% (National Population Commission, 2006).

The primary production activities of the communities are agricultural production, livestock rearing and horticulture. Tertiary activities are marketing of agricultural products, transportation and crafts while secondary activities are hunting and blacksmithing (making traditional farm tools). Kaduna State has a suitable climatic and environmental conditions favoring agricultural production and is becoming notable in rainfed upland and lowland rice production. According to Chuma (2005), "Kaduna State was the highest rice producing state in the year 2000 when it produced 22% of the country's 2 million metric tons of domestic rice." The Kaduna State Agricultural Development Programme is the agricultural extension delivery arm of the state Ministry of Agriculture. It generates recommended farming technologies (in all sub-sectors of agriculture) from relevant Agricultural Research Institutes and disseminates them

through village extension agents to farmers for adoption. The Kaduna State Agricultural Development Programme have disseminated many agricultural technologies to farmers for adoption. However, due to farmers' socio-economic variables, adoption have not received the desired results as many recommended certified rice seed varieties for both upland and lowland production have been introduced for adoption but many farmers after using these seeds in the first season often fail to renew them. Many farmers continued to use grains harvested from the previous season for planting in the subsequent year. Majority of the population in the studied communities are small scale farmers. They cultivate farm sizes of less than 5 hectares. The rice production house hold heads are predominantly males. Most of the labor used in production is family labor but this is often supplemented with other forms of none family labor (hired, labor exchange). Intercropping is common in upland rice production but sole cropping is a common feature in lowland rice production.

The location of Kaduna State is between Longitude 6^0 and $9^0$10' East of the Greenwich Meridian and also between Latitude 9^0 and 11°30' North of the Equator. The state occupies an area of approximately 48,473.2 square kilometers (4.5million hectares) with a total land area of 2.2million hectares under cultivation out of which 1.84 million hectares is upland while 0.08 million hectares is fadama land Area (K.A.D.P, 2010). The State has a population of 7,805,131 people in 2014 by projection of the 2006 census figures on an annual growth rate of 3.2% (National Population Commission, 2006). There are two seasons in the State, the dry season and the rainy (wet) season. The wet season is usually from April to October with great variations as one moves northwards. It has an average annual rainfall of 1016mm. Its vegetation extends from the Guinea Savannah in the south to the Sudan Savannah in the North.

The communities studied have the potential for surplus production but they are constrained by poor infrastructure, antiquated farm equipment, and farm inputs. The agricultural sector seems to be unappealing to the youths as they have moved enmasse from the rural to sub-urban and urban areas in search of better opportunities thus compounding the unemployment problem in the state. problem in the state.

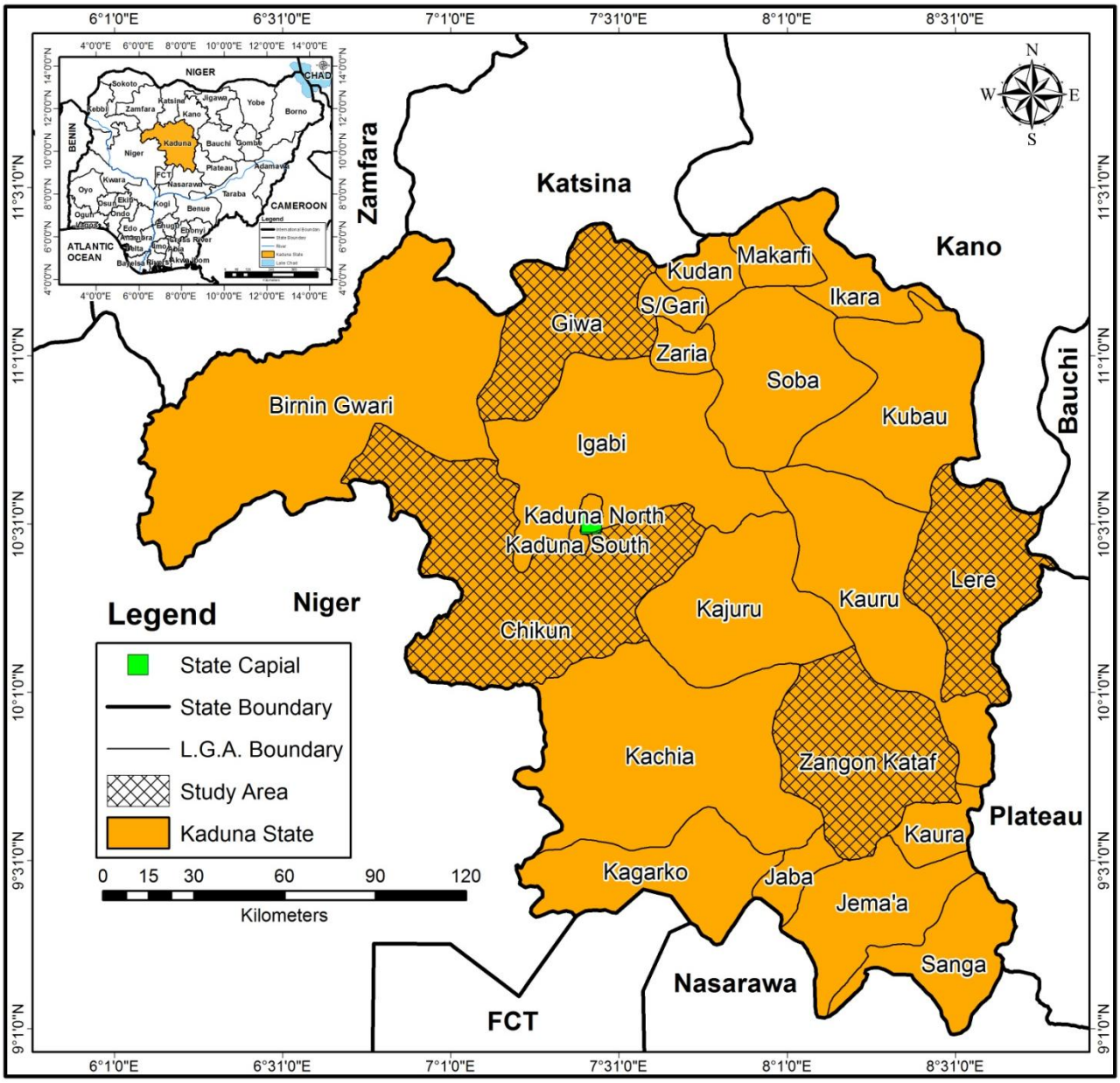


Figure 3:1. Map of Kaduna State showing the study area.

3.2 Sampling Procedure and Sample Size

The target population studied was small scale contact farmers from the four zones of Kaduna State Agricultural Development Project (KADP). Before the selection of respondents, a reconnaissance survey was carried out to identify the rice producing Local Government Areas in each of the four zones of the Kaduna State Agricultural Development Programme. Respondents were then selected using the multi-stage sampling technique. In the first stage, purposive sampling was used to select one Local Government Area from each of the four zones of the Kaduna State Agricultural Development Project based on the area having the highest concentration of rice farmers, certified rice seed growers and extension activities. In the second stage, one extension block was purposively selected from each of the selected four Local Government Areas based on the basis of having the highest numbers of rice farmers and extension activities. In the third stage, two extension cells (extension agent's duty coverage area) were purposively selected from each of the selected extension blocks on the basis of having the highest concentration of rice farmers and extension activities. This gave a total of eight selected cells. There were 80 contact farmers in each cell whom the extension agent focused attention during his fixed fortnightly visits. The 80 contact farmers in each of the 8 selected extension cells are the sample frame of 640 from which 30% were selected using the simple random sampling technique without replacement. This gave a sample size of 192 respondents.

Table 3.1. Sampling Procedure and Sample Size

ADP Zone	Purposively selected Local Government Area	Purposively Selected Block	Purposively Selected Cell	Number of contact farmers	Randomly Selected Respondents (30%)
Birnin	Chikun	Kujama	Kujama	80	24
Gwari			Janruwa	80	24
Lere	Lere	Saminaka	Saminaka	80	24
			Yarkasuwa	80	24
Maigana	Giwa	Giwa	Yakawada	80	24
			Kaya	80	24
Samaru	Zangon-Kataf	Samaru	Madakiya	80	24
			Samaru	80	24
Total				**640**	**192**

3.3 Methods of Data Collection

Both primary and secondary data were used. Secondary sources of information were journals, text books, proceedings, bulletins, magazines, newspapers, proceedings, internet and other existing literature relevant to the study including those of the Kaduna State Agricultural Development Programme. Primary data was collected through the use of structured questionnaire with both open and closed ended questions.

The questionnaire were administered to the respondents in the eight extension cells in the months of December 2012 and January 2013. The data collected were on socioeconomic characteristics of respondents namely age, years of formal schooling, farm size; institutional variables were, distance to seed source, extension contact, membership of social groups/organizations, amount of credit accessed and the technological variables were, relative advantage, compatibility, complexity, trialability

and divisibility. Other data collected were on sources of certified seeds and their complementary inputs, respondents' awareness of the recommended certified rice seed technology and it's agronomic practices, extent of adoption of the certified rice seed technology and the mean yield, income and material possession (level of living indicators) of respondents before and after adoption of the technology.

3.4 Analytical Techniques

For the descriptive statistics such as frequency distribution, percentages, range and mean were used to achieve the socio-economic characteristics of farmers, describe the extent of adoption, ascertaining the extent of usage of the recommended certified rice seeds and their sources, analyze the effects of adoption on farmers' yield, income and level of living and the constraints faced by farmers in the adoption of the recommended certified rice seed technology. Multiple regression was used to analyze the socioeconomic, institutional and technological factors that influenced the adoption of the recommended certified rice seed technology. The multiple regression technique was also used to estimate the contributions of each socioeconomic, institutional and technological variable that affect the adoption of the certified seed technology and in testing the Hypothesis. Generally, data were organized and analyzed using Statistical Package for Social Sciences. The regression model was specified as follows,

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + e$$

Where:

Y = adoption of certified rice seed technology (percentage).

X_1 = Age (years)

X_2 = Years of formal schooling (number of years of formal schooling)

X_3 = Farm size (hectares, Ha)

X_4 = Distance to seed source (kilometers, km).

X_5 = Extension visits (number of visits) in 2011

X_6 = Membership of social groups/organizations (Yes= if a member, No= if otherwise)

X_7 = Amount of Credit Accessed (amount in naira)

X_8 = Relative Advantage: This was measured using five point score as highly agree = 5, agree = 4, undecided = 3, disagree = 2 and highly disagree = 1.

X_9 = Compatibility: (highly compatible = 5, compatible =4, undecided = 3, compatible = 2 and highly incompatible = 1).

X_{10} = Complexity: (easy= 5. relatively easy = 4, undecided = 3, complicated = 2 and highly complicated = 1).

X_{11}= Trialability: (highly trialable = 5, trialable = 4, undecided = 3, not trialable = 2 and highly not trialable = 1)

X_{12} = Divisibility: (highly divisible = 5, divisible = 4, undecided = 3, indivisible= 2 and highly indivisible = 1)

a - Constant

$b_1 – b_{12}$ - regression coefficient

e = error term

Objective 5 was measured using effect size (raw mean difference scores) of the before and after adoption in assessing the magnitude of the technology effect on farmers' yield, income and level of living. Effect size, according to Marilyn and Jim (2011) is a descriptive statistic used in measuring the strength of a relationship between variables (the magnitude of differences between two groups). The model was specified as;

$$D_i = \left[\left(\frac{1}{n_j}\sum_{j=1}^{n} A_j\right) - \left(\frac{1}{n_j}\sum_{j=1}^{n} B_j\right)\right]$$

Where,

D = Measure of effect

A= After adoption (yield, income or level of living)

B = Before adoption (yield, income or level of living)

n = Number of respondents

i = Range

j = Respondents in i (range)

3.5 Measurement of Variables

3.5.1 Independent variables

Socio-economic characteristics

(a) Age (X_1)**:** This is the period of time a person has lived or existed. Age was measured as the actual age given in years.

(b) Years of formal schooling (X_2): Each respondent was asked to give the number of years he/she spent in school. The total number of years in school constitutes the farmer's educational score.

(c) Farm Size (X_3): Farm size refers to the total area of land cultivated by the farmer in 2011. Farm size was measured in hectares (Ha).

Institutional Variables

(d) Distance to Seed Source (X_4**).** This refers to the distance that separates the farmer from the source of the recommended certified seeds and other farm inputs. Distance to seed source was measured in kilometers (km).

(e) Extension Visits (X_5**).** This refers to the number of visits extension officials made to farmers. It was measured by the number of visits of an extension agent to a farmer and vice versa.

(f) Membership of Social Groups or Organizations (X_6). This refers to farmers who were members of organizations like Farmers' Cooperative Societies. This was measured as Yes=1, if a member, No=O, if otherwise.

(g) Amount of Credit Accessed (X_7)**.** This represents loans and advances received either in cash or in kind by the respondent. It was measured in naira (₦).

Technological characteristics

(h) Relative advantage**:** This refers to the degree to which the recommended technology is seen as more advantageous to the one it is meant to replace. This was measured using five point score as; strongly agree = 5, agree = 4, undecided = 3, disagree = 2 and strongly disagree = 1.

(i) Compatibility: This is the degree to which the technology fits into an existing situation of ideas and beliefs of the farmers. A technology that is compatible will be more likely to be adopted quickly. This was measured using five point score as; highly compatible = 5, compatible = 4, undecided = 3, incompatible = 2 and highly incompatible = 1.

(j) Complexity: It is the degree to which the technology is relatively difficult to follow and not relatively easy to understand and use. Some technologies are easily understood by farmers while others are more complex. A technology that is relatively easy to understand will tend to be more likely adopted than complex ones. This was measured using five point score as; easy = 5, relatively easy = 4, undecided = 3, complicated = 2 and highly complicated = 1.

(k) Trialability (X_{11}). This is the degree to which the recommended certified rice seed technology may be experimented or tried. This was measured using five point score as; highly trialable = 5, trialable = 4, undecided = 3, not trialable = 2 and highly not trialable = 1.

(l) Divisibility (X_{12}). This refers to the degree to which the recommended certified rice seed technology can be tried in parts or phases. This was measured using five point score as; highly divisible = 5, divisible = 4, undecided = 3, indivisible = 2 and highly indivisible = 1.

3.5.2 Dependent variable

Adoption (Y): Adoption was the acceptance and continuous use of the recommended certified rice seed agronomic practices by farmers. In this study, the adoption of eight agronomic practices contained in the certified rice seed technology as recommended by Institute for Agricultural Research, Samaru, Zaria by Ukungwu, *et al*. (2004) were examined. This was because whenever crop varieties are released by research, there are agronomic practices in place for these varieties' potentials to be realized, but where farmers' are not using these recommended agronomic practices in full, their efforts will not yield the desired results. The certified rice seed technology has the following recommended agronomic practices,

(i) Use any of these recommended certified rice Seeds. NERICA, FARO 27, FARO 15, WITA 4 (FARO 52), FARO 44 (SIPI).

(ii) Use the recommended Seed dressing: Apron Plus. One satchet to three kg. seed

(iii) Use the recommended Planting date: June to Mid-July.

(iv) Use the recommended planting spacing: 20cmx20cm on flats

(v) Use the recommended Timely weed control measures**:** Manual weeding, 2-3weeks after sowing and 4-6weeks later. For Herbicide weed control, apply Pre-emergence herbicide such as Pendillin 500EC at the rate of 1.5-2 litres /Ha and a Post-emergence like Orizo 320EC at the rate 0f 4-6 litres /Ha. Supplimentary hand pulling of weeds.

(vi) Use the recommended Fertilizer Application**:** Apply 400kg of N. P. K. 15:15:15 as basal dose/ha and Top dress with 100kg of Urea/Ha, 4-6weeks later.

(vii) Use the recommended Pests and Diseases Control measures:

To control soil pests; apply **F**uradan 3G or Worm force at the rate of 3kg/ha,

To control fungus diseases; apply Benlate at the rate of I kg/Ha

To control spittle bugs, sucking bugs and grasshoppers; apply systemic insecticides like Best Action or Uppercott at the rate of 100-150 mls / knapsack sprayer.

(viii) Use the recommended Harvesting Time: Harvest when 80% of grains on panicles are straw colored.

The extent of adoption was measured by describing in the questionnaire how each recommended agronomic practice in the technology was expected to be used so that the interviewers could check to ensure the validity of the recorded information. The extent of adoption was therefore measured by scoring one point (1) = yes for each agronomic practice adopted by the respondent and (0) =no, if otherwise. It is represented as follows;

$$\text{Extent of Adoption (Y)} = \frac{\text{Number of agonomic practices adopted}}{\text{Total number of agonomic practices in the technology}} \; X \frac{100}{1}$$

A respondent who scored 4points or 50% and above was regarded as an adopter (having adopted at least four out of eight agronomic practices as recommended) and one who scored less than 4points or 50% was a non adopter. The extent of adoption was calculated as the number of agronomic practices adopted, divided by the total number of agronomic practices in the technology and expressed in percentage. The average extent of adoption of the technology was calculated by adding the percentage adoption level of all the agronomic practices and dividing them by 8, which is the total number of agronomic practices in the technology.

3.5.3: Effects of adoption on yield, income and level of living

The effect of adoption was the differences in the respondents' mean yield, income and quality of life (material possession) in the year before adoption and the year after adoption.

Yield: This refers to the total quantity of rice (paddy) harvested in kg/ha by a farmer after adopting the certified rice seed technology within the season of the study (2011).This yield after adoption was compared to the yield of the farmer in the year before adoption. The difference between the two yields was the effect of adoption on the respondents.

Income: This refers to the money earned from rice after adopting the recommended certified seed technologies in the season (2011).This income was compared to the income earned by the farmers in the year before adoption. Income was measured in terms of the amount of money (cash) respondents earned from their rice in the year before and after adoption in naira (₦).

Level of Living. This is the quality of life of the farmer. The major indicators of level of living were, savings, farm income, possession of durable materials such as radio, motorcycle, farm animals, zinc roofs and farm tools. Level of living was measured by comparing the durable materials farmers were able to purchase in the year before and year after adoption. These assets were valued in naira (₦), summed up and compared. The inflationary trend was considered and added to the net worth of the assets to the year before adoption.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the results and discussions of this study. It focuses on the findings related to the objectives of the study.

4.1 Socio-economic Characteristics of Farmers in the Study Area

The farmers' socio-economic variables examined were, age, years of formal schooling, farm size, distance to seed source, extension contact, membership of social groups/organizations and amount of credit accessed.

4.1.1 Age of Respondents

4.1.1 Age of Respondents

The study revealed that the highest number of farmers in the different age categories was in the age category of 40-49 years and the average age of the farmers was 43 years. This finding is consistent with those of Nwanko *et al.* (2009), Institute for Agricultural Research (*2001)* and Mubarik *et al.* (2001) who reported that the farmers engaged in agricultural production are in the active age group 31-50 years.

Table 4.1. Distribution of respondents according by age

Age	**Freq**	**%**
20 – 29	9	4.7
30 – 39	60	31.3
40 – 49	77	40.1
50 – 59	33	17.2
> 60	13	6.7
Total	**192**	**100**
Min 23		
Max 63		
Average 43		

4.1.2 Years of formal schooling

Results in Table 4.2 reveal that 14% of respondents had no formal education while 21, 32 and 33% attended primary, secondary and tertiary schools respectively. The highest percentage of respondents had tertiary education which was closely followed by secondary education. It is generally documented and accepted that educational status of farmers increases their adoption level because they have the ability to gather more reliable agricultural information that would enable them make good decisions on their farm production activities. According to Osuji (1983), a community with a high illiterate component has less access to accurate information sources and may resort to neighbors and hearsays as media for getting information. The high literate proportion of the respondents in the study area implied that more literate individuals had embraced farming and that more farmers are better exposed to reliable information sources for awareness and adoption.

Table 4.2. Distribution of Respondents According to years of formal schooling

	Frequency	**Percentage**
No formal education	26	13.5
Primary	40	20.8
Secondary	62	32.3
Tertiary	64	33.3
Total	**192**	**100**

4.1.3 Farm Size

Table 4.3 shows that 42% of the respondents cultivated farms of less than 3 hectares each while 36% and 11% cultivated 3-4.9 and 5.0-6.9 hectares each respectively; Only 1% cultivated more than 6.9 hectares each. The average farm size cultivated by the respondents was 3.9 hectares. It should be noted that farmers own several plots or farms

which is known as farm holding while farm size refers to the area cultivated. According to Ogunbile and Olukosi (1991), "Over 81% of farm holdings in Nigeria in 1991 were owned by small scale farmers and the farm sizes were generally small partly as a result of inheritance with the resultant effect of a farmer cultivating less than 6 hectares." Even thou small scale farmers often try to maximize the use of their farm lands, small farm size may not favor commercial rice farming and large scale mechanization. However it was expected that farm size would favor adoption of the recommended certified rice seed technology.

Table 4.3: Distribution of Respondents According to farm Size

Farm size (ha)	**Freq**	**%**
1.0 – 2.9	80	41.7
3.0 – 4.9	70	36.5
5.0 – 6.9	21	10.9
7.0 – 8.9	10	5.2
9.0 – 10.9	7	3.6
11.0 – 12.9	2	1.0
>12.9	2	1.0
Total	**192**	**100**
Min 1		
Max 21		
Average 3.9		

The distribution of respondents according to methods of land acquisition in Figure 4:1 shows that 80% of the respondents acquired their farmlands through inheritance, 20 % acquired through hire, 19% acquired through borrowing and 17% through purchase. As majority of farmers inherited their farmlands, the implication is that these lands which belonged to family members may further be sub-divided as the population of family members increased. Furthermore, majority of inherited lands have no title rights and therefore have no security of tenure

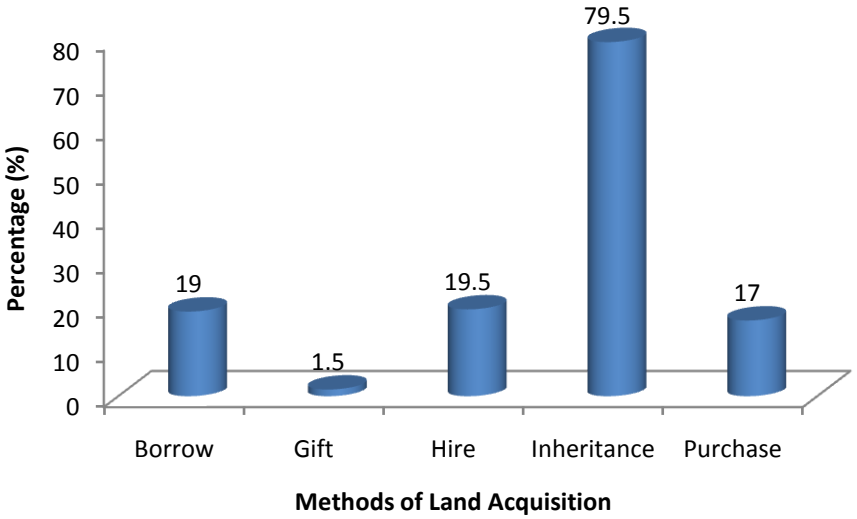


Figure 4:1. Distribution of Respondents According to Methods of Land Acquisition (n=192)

4.1.4. Distance to seed source

Table 4.4 shows that 76.0%, 21.0% and 3% of the respondents reside between 0-8, 9-17 and 18-26 kilometers respectively away from their seed sources respectively. Since majority of respondents are within 10 km from their seed sources, they were not constrained by distance in accessing the recommended certified seeds for adoption.

Table 4.4. Distribution of respondents according to distance from Seed Sources

Distance (km)	**Freq**	**%**
0 – 8	151	75.5
9 – 17	42	21.0
18 – 26	6	3.0
27 – 35	1	0.5
Total	**192**	**100**
Min 0		
Max 32		
Average 7.0		

When respondents were asked to indicate the presence or absence of certified seeds and other input sales agents in their localities, 28% indicated that they had seed sales agents in their localities while 71 % did not have (Table 4:5). There were situations where seeds and other farm input supply were irregular especially during peak periods of demand. When the respondents were asked whether they had regular seed supply or not, 37% indicated that they had and 63% did not have. The absence of a regular supply of farm inputs poses a serious obstacle in maintaining technologies that have been adopted.

Table 4.5 Distribution of respondents according to the presence or absence of recommended certified rice seeds and other farm input sales agents in their locality

Presence/absence of sale agents	**Frequency**	**Percentage**
Present	54	28
Not present	138	72
Total	**192**	**100**

4.1.5. Extension visits

Table 4.6 shows that in the year 2011 alone, 52% of the respondents had 1-15 visits by extension agents, 35% had 10-30 visits, 11% had 31-45 visits while only 2% had more than 45 extension visits. The high number of visits might have probably been due to intensified farm and home visits as respondents were contact farmers who are expected to be visited by village extension agents once in every fortnight. This result is in line

with the apriori expectation that because of the regular contact with extension, farmers would be more enlightened about the potential gains from adopting introduced technologies. This result is consistent with the findings of Orisakwe and Agomuo (2011) who reported that regular contacts with extension workers motivates and exposes farmers to innovations.

Table 4.6. Distribution of Respondents According to Number of Extension Visits in 2011

Extension Contact	**Freq**	**%**
1 – 15	102	52.0
16 – 30	68	35.0
31 – 45	21	11.0
46 – 60	3	2.0
Total	**192**	**100**
Min 2		
Max 52		
Average 17		

4.1.6 Membership of social groups/organizations

Result from the study (Table 4:7) indicated that only 29% of the respondents were members of social groups or organizations while 71% were not. This showed that majority of the respondents were not members of any social groups or organizations. The reason for the low membership of groups may be traced to the Training and Visit Extension System adopted which was specifically designed for extension personnel to focus on individual farmers (contact farmers) rather than groups. These contact farmers were in turn expected to diffuse agricultural technologies taught to them by extension agents to other farmers in the social system.

Table 4.7. Distribution of respondents according to membership of social groups

Membership	**Frequency**	**Percentage**
Yes	58	29.00
No	142	71.00
Total	**192**	**100**

4.1.7 Amount of credit accessed

The findings (Table 4:8) revealed that 72% of respondents did not accessed credit while the rest accessed credit as follows; between ₦1000 - ₦49,999 (12% of respondents), between ₦50,000- ₦99,999 (5.2% of respondents), between ₦100,000-149,999 (8.3% of respondents), between ₦150,000-199,999 (2.1% of respondents) and 0.5% accessed more than ₦199,999. The finding indicated that less than one third of the respondents were recipients of credit. Even thou formal credit system opportunities (such as Bank Of Agriculture, Community Banks, Cooperatives) were open to farmers in the past few years, a larger proportion of them could not utilize.

Table 4.8**.** Distribution of Respondents According to Amount of Credit Accessed

Credit Amount (N)	**Freq**	**%**
Could not accessed credit	138	72.0
1000 - 49,9999	23	12.0
50,000 – 99,999	10	5.2
100,000 – 149,999	16	8.3
150,000 – 199,999	4	2.1
> 199,999	1	0.5
Total	**192**	**100**
Min 0		
Max 200,000		
Average 21,544		

4.1.8 Respondents' sources of credit

Table 4:9 shows that 72% of the respondents had no sources of credit while 28% accessed credit through relatives and friends, banks, money lenders, agricultural agencies and social groups/organizations. The credit was mainly from private sources, implying that the private sector if properly harnessed would be a willing partner in providing loanable funds to serve the credit needs of farmers.

Table 4.9. Respondents' Sources of Credit for rice production.(sources were in multiple responses).

Source of Credit	Frequency	Percentage
None source of credit	138	72
Agricultural Agencies	21	38.9
Banks	26	48.1
Money Lenders	22	40.7
Relations and Friends	43	79.6
Social Groups/ Organizations	17	31.5

4.2 Sources of Certified Rice Seeds and other Farm Inputs .

Respondents' sources of certified seeds and complimentary farm inputs were examined. Table 4.10, shows that majority of the respondents got their recommended certified seeds and other farm inputs from three major sources namely, the open markets, dealers and government. This finding revealed the important role the private sector can play in partnership with the government towards the provision of farm inputs to our farming communities The government source of seed was from the Federal Government's ongoing Gross Enhancement Support Scheme (G.E.S.S) under the Agricultural Transformation Agenda Programme (ATAP). This scheme was introduced in 2012 whereby Nigerian small scale farmers were registered and each was and will continue to be issued with two bags (50kg size) of fertilizers and 10 kg of recommended improved seeds of either rice or maize annually at subsidized prices. According to Food- Farm News (2012), before the Agricultural Transformation Agenda Programme, an improved seed adoption was less than 10%.

Table 4.10. Distribution of respondents according to their sources of certified rice seeds and other farm inputs.(multiple responses)

Input	Source	Frequency	Percentage
Certified rice seeds	Open market	68	35
	Dealers/agents	63	33
	Government	58	30
	Seed companies	3	2
Herbicides	Dealers/agents	112	58
	Open market	73	38
	Government	8	4
Insecticides	Dealers/agents	121	63
	Open market	61	32
	Government	5	5
Sprayers	Open market	104	54
	Government	49	26
	Dealers/agents	39	20
FarmTools (hoes,cutlasses)	Open market	162	162
	Dealers/agents	9	5

4.3 Extent of Adoption of the Recommended Certified Rice Seed Technology

The study revealed in Table 4:11 that the average extent of adoption of the certified rice seed technology was 57%. The most adopted agronomic practices in the technology were, using the recommended planting date of June- mid July (69%), using recommended certified rice seeds (68%), using recommended timely weed control measures (67%). The least adopted agronomic practices were the use of recommended pests and diseases control measures (40%) and the use of recommended fertilizer application (44%). The reason for the least adopted agronomic practices was likely due

to the high cost of fertilizers and agro-chemicals. The extent of adoption of the recommended agronomic practices was generally above average, however the farmers failed to apply them in full.

Table 4.11: Extent of adoption of the recommended certified seed technology (n=192)

Agronomic practices	**Adoption level %**
Using the recommended planting date	68.75
Using of the recommended certified rice seeds	67.71
Using the recommended weed control measures	67.19
Harvest at the recommended time.	66.67
Using the recommended plant spacing of planting	62.50
Using the recommended Seed treatment.	47.92
Using the recommended fertilizer application	43.7
Using the recommended pests and diseases control measures:	39.58
Average extent of adoption	57.00

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4.4 The Socio-economic, Institutional and Technological Factors that Influenced Adoption of the Certified Rice Seed Technology

Table 4.12 shows the socio-economic, institutional and technological factors that influenced the adoption of the certified rice seed technology. The estimated R-square value was 0.45. This implied that 45% of the variations in the adoption of certified seed technology package was explained by the independent variables considered in the model. The F-value, 2.18 was significant at 5% level of probability which implied that the independent variables included in the model contributed in explaining the variations in the adoption of the certified rice seed technology.

Education was positively and significantly influential to the adoption of the recommended technology with a coefficient of 2.095. This variable was significant at

5% level of probability. This result implied that as education increases adoption level also increases among farmers. This result is consistent with previous studies by Voh (1979); Osuji (1983); Atala (1984); Umunna (2010) and Kudi *et al.* (2010). Also exposure as a result of education permits an individual to develop the ability to store and retrieve information for later use (Sheba, 1997). Umunna (2010) reported that education had very important influence on the ability to access information and communication media. Thus the ability of a farmer to access the communication media for effective decision making on adoption of technologies is positively related to his/her educational attainment. Low educational attainment of farmers could negatively affect their accessibility of communication media.

The coefficient for membership of social groups was 2.387. It was positively and significantly influential to the adoption of recommended technology at 5% level of probability. Membership of social groups provided means of interaction with other farmers and avenue through which innovations diffuse faster among farmers. This result Jagne and Patel (1981)is in line with the findings of and also agreed with the expectation that adoption can be facilitated through farmers' groups.

Amount of credit accessed had a coefficient of 2.424. It was significantly and positively influential to the adoption of technology at 5% level of probability. This result implied that increase in the amount of credit received would increase the level of adoption among farmers. Amount of credit accessed can increase farmers' liquidity thereby increase their accessibility to inputs required to adopt the technology. This finding is consistent with previous studies such as Osuji (1983); Atala (1984); Njoku (1991) and Kudi *et al.* (2010). The importance of credit in the adoption of technologies cannot be

over emphasized because improved capital would encourage a farmer to spend more on recommended practices that would further increase his farm yield and income. Extension contact with a coefficient of 3.054 was significantly and positively influential to adoption of the technology at 1% level of probability. This implied that the adoption level would increase as the number of contact with extension staff increases even though the estimated parameter was significant at 1% level of probability against the chosen 5% level of significance. This study is similar to previous researches conducted by Njoku (1991); Kudi *et al. (2010);* Obeta and Nwagbo (1991*).* Institute for Agricultural Research (2001) noted that contact with extension is more effective in facilitating adoption especially if such contact was directly related to the technology in question.

Trialability which had a coefficient of 3.251 was positively and significantly influential to adoption of technology at 1% level of significance. The positive coefficients showed that there exist a relationship between trialability and adoption. This result was consistent with the result obtained by *Rogers (2003)* who found that trialability was positively correlated with the rate of adoption. He further noted that the more an innovation was tried, the faster it's adoption. An innovation that is triable represents less uncertainty to the individual who is considering it for adoption. The significance of trialability with adoption of the certified rice seed technology was not surprising as the introduction of New Rice for Africa (NERICA) had given rise to intense promotion for rice crop production in Kaduna State through R-Box, On Farm Adaptive Research (OFAR), Small Plot Adoption Techniques (SPAT) and Management Training Plots (MTP).

The variables that were not significantly related to the adoption of the technology were age, farm size, distance to seed source, compatibility, complexity and relative advantage. Age had a negative coefficient (-0.923). Age therefore had a significant negative impact on adoption implying that the older the respondent, the lesser likelihood of adopting the technology. Farm size had a positive coefficient (1.368) but made no significant contributions to adoption of the technologies. Distance to seed source had a positive coefficient (0.498) but did not have a significant impact on adoption. However, where majority of farmers reside far away from their seed sources, they will require good access roads and transport to enable them travel quite often for inputs to sustain adoption. Compatibility variable had a negative coefficient (-0.062). This implied that it made a significantly negative contribution to adoption of the technologies. Complexity and Relative Advantage had positive coefficients of 0.604 and 0.668 but had no significant impact on adoption of the technologies. The non significance of the variables, compatibility, complexity and relative advantage implied that extension personnel should put more efforts in conducting method and result demonstrations of introduced technologies.

The result of the multiple regression analysis (Table 4.12) was used to test the null hypothesis which stated that "There is no significant relationship between the socio-economic, institutional and technological variables of farmers and adoption of the recommended certified rice seed technology. The result shows that farmers' socio-economic, institutional and technological variables had a significant effect on adoption of the certified rice seed technology at 1% level of significance as adoption had influence on farmers' yield and income and level of living. The null hypothesis is hereby rejected.

Table 4.12: Regression analysis of Factors that Influenced the Adoption of the Certified rice Seed Technology.

Variable	Regression Coefficients	Standard Error	T-Value
Constant	5.947	3.548	1.676 *
Age	-0.247	-0.267	-0.923
Years of formal schooling	0.088	0.042	2.095**
Farm size	0.410	0.300	1.368
Distance to seed source	0.019	0.037	0.498
Membership of social groups/organizations	0.549	0.230	2.387**
Amount of credit accessed	0.618	0.255	2.424**
Extension contact	0.568	0.186	3.054***
Compatibility	-0.023	0.374	-0.062
Complexity	0.352	0.584	0.604
Relative Advantage	0.106	0.159	0.668
Trialability	1.554	0.478	3.251***
R-Square			0.454
R-Square Adjusted			0.405
F-Value			2.187 □ □

□ □ □= P <0.01,

□ □ = P <0.05,

□ = P <0.10,

4.5. Effect of Adoption on Farmers' Yield, Income and Level of Living

Results presented in Table 4.13 shows the effect of adoption of the certified rice seed technology on farmers' yield, income and level of living before and after adoption. The mean yield of the farmers between 1-2500kg/ha range were 853.28 kg/ha and 2,207.8kg/ha before and after adoption respectively with a yield difference of 1,354.5kg.Those farmers that obtained yields between 2501-5000kg/ha range had mean yields of 3,841.8kg/ha and 4,501.4kg/ha before and after adoption respectively with a mean yield difference of 659.6kg.Those who obtained yields above 5,000kg/ha range had mean yields of 5,057.1kg/ha and 6,885.71kg/ha before and after adoption respectively with a mean yield difference of 1,828.6kg.The result shows that the mean

yields after adoption were higher than those before adoption. The difference between the mean yields is the effect of adoption of the certified rice seed technology on farmers' yield. The difference is therefore the change that occurred as a result of adoption.

The mean income of the farmers who earned between 1001-50,000 naira range were 28,920.1 naira before adoption and 122,058.5 naira after adoption with a mean income difference of 93,138.3 naira. The mean income of those farmers who earned between 50,001-100,000 naira range were 69,028.4 naira before adoption and 135,642.2 naira after adoption with a mean income difference of 66,613.8 naira while the mean income of those who earned above 100,000 naira range were 244,515.3 naira and 297,676.7 naira before and after adoption respectively with a mean income difference of 53,161.3 naira. It was observed that the mean income of the farmers was higher after adoption. This was attributed to the adoption of the certified rice seed technology. The mean level of living of the farmers within 1001-50,000 naira range before and after adoption was 20,441.2 naira and 33,372.7 naira before and after adoption respectively with a mean difference of 12,931.5 naira. Those farmers that earned 50,001-100,000 naira range earned a mean level of living of 62,849.4 and 135,642.2 naira before and after adoption respectively with a mean difference of 14,244.5 naira while those that earned above 100,000 naira range earned a mean level of living of 162,875.0 and 289,125.0 naira before and after adoption respectively with a mean difference of 126,250.0 naira. The findings revealed that the farmers' mean level of living before the adoption was lower to the mean level of living after adoption. The study revealed that changes have occurred in farmers' level of yield, income and living after adoption of the certified rice seed technology

Table 4.13: The effect of adoption on farmers' yield, income and level of living

Range	Before adoption	After adoption	Difference	Difference %
Yield(Kg/Ha)				
1-2500	853.3	2,207.8	1354.5	158.7
2501-5000	3,841.8	4,501.4	659.6	17.2
>5000	5,057.1	6,885.7	1,828.6	36.2
I**ncome((₦**/Ha)				
1001-50000	28,920.1	122,058.5	93,138.3	322.0
50001-100000	69,028.4	135,642.2	66,613.8	96.3
>100000	244,515.3	297,676.7	53,161.4	21.4
Level of living (₦)				
1001-50,000	20,441.2	33,372.7	12,931.5	63.3
50001-100000	62,849.4	77,093.9	14,244.5	22.7
>100000	162,875.0	289,125.0	126,250.0	77.5

4.6. Constraints Faced by Farmers in the Adoption of the Recommended Certified Rice Seed Technology.

The major constraints faced by farmers as shown in Table 4.14 were lack of sufficient funds (96.00% of respondents), lack of access to credit facilities (94.00% of respondents), lack of regular supply of recommended inputs (67.00% of respondents), limited knowledge of recommended agronomic practices (53.00% of respondents) and input adulteration (34.00% of respondents).These constraints posed a limitation to adoption of the certified rice seed technology.

Table 4.14: Farmers' constraints in the adoption of the recommended certified seed technology package for rice (n=192)

Constraints	**Frequency**	**Percentage**
Lack of sufficient funds	184	95.80
Lack of access to credit facilities	180	93.80
Lack of regular supply of recommended inputs	128	66.70
Limited knowledge of recommended agronomic practices	102	53.10
Input adulteration	65	33.90

(Multiple responses)

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The broad objective of this study was to identify the socioeconomic, institutional and technological factors that influenced the adoption behavior of farmers on recommended certified rice seed technology. Primary data were collected through questionnaire from 192 contact farmers in four selected rice producing Local Government Areas of Kaduna State. Descriptive and inferential statistics were used to analyze the data. The study revealed that the highest number of farmers was in the age category of 40-49 years and their average age was 43years. The average farm size cultivated by farmers in 2011 was 53.90 hectares, extension visits to farmers was high (86%) Majority of the farmers (70%) did not belong to social groups/organizations. Only 54 of the farmers (28%) accessed credit. Majority of the farmers (63%) did not have regular farm input supply. The major sources of farm inputs was the open markets through input dealers and government Growth Enhancement Support Scheme (GESS). The average extent of adoption of the recommended agronomic practices in the technology was 57%.

The regression result shows that the variables, years of formal schooling, membership of social groups and amount of credit accessed were significant to adoption of the certified rice seed technology at 5% level while extension contact and trialability were significant to the adoption of the technology at 1% level. The null hypothesis which stated that "There is no significant relationship between the socio-economic, institutional and technological variables of farmers and adoption of the recommended certified rice seed technology." was rejected because adoption was significantly affected by farmers' socio-economic, institutional and technological variables at 1% level. The

effect of adoption on farmers' yield, income and level of living shows that as a result of adoption, farmers had higher mean yield, income and level of living after adoption than those before adoption. Majority of farmers moved from having lower mean yields before adoption to having higher mean yields after adoption. Similarly the farmers moved from having lower mean income before adoption to higher mean income after adoption. Farmers' also moved from lower mean level of living before adoption to higher mean level of living after adoption. Major constraints faced by farmers were insufficient funds, inability to access credit, absence of regular supply of farm inputs and limited knowledge of the agronomic practices.

5.2 Conclusion

The main sources of the seeds and other farm inputs was open markets .The average extent of adoption of the certified rice seed technology was 57%.. The factors that were significant in influencing the adoption of the certified rice seed technology were, extension contact, triability, amount of credit accessed, membership of social groups and years of formal education. Those factors that made no significant contributions to the adoption were, age, farm size, distance to seed source, relative advantage, compatibility and complexity. Farmers' mean yield, income and level of living after the adoption were higher than those before adoption meaning that adoption have changed farmers' level of yields, income and living. Because adoption can change farmers' level of yields, income and living, it offers economic opportunities to them. Farmers were constrained by lack of sufficient funds, inability to access credit, lack of sustainable sources of input supply and limited knowledge of recommended agronomic practices.

5.3 Contribution to knowledge

(i)The study found that the extent of adoption of certified rice technology was 57%.

(ii) Adoption of the certified rice seed technology had positive and significant influence on increased farmers' yield, income and level of living.

5.4 Recommendations

(i) It was found in the study that majority of farmers did not belong to social groups/organizations. It is therefore recommended that extension services should intensify efforts in organizing farmers into viable cooperative societies to enable them solve their common problems.

(ii) It was found in the study that the supply of recommended seeds and other farm inputs was not regular. It is recommended that government and the private sector should partner in areas such as provision of adequate supporting infrastructures, delivery and supportive services and training of small local business owners to sell recommended certified seeds, fertilizers and other inputs to ensure their steady supply.

(iii) It was found that farmers could not apply recommendations in full due to the expensiveness of the recommended inputs specifically fertilizers and agrochemicals. It is recommended that government should partner with the private sector through offering incentives such as relaxing tariffs on imports and levies on input processing equipment, manufacturing, blending and credit facilities to the private sector for the manufacture, blending, distribution and supply of these inputs at affordable prices.

(iv) Extension contact was positive and significantly influential to adoption. Therefore, it is recommended that extension service should carry out more demonstrations and field days for farmers to see so as to increase adoption.

(v) It was found that access to credit from formal sources was a major constraint. It is recommended that farmers should organize themselves into credit relieving societies to take care of their financial needs since it is difficult to obtain loans from formal sources.

5.5 Suggestions for further research

(i) There is the need for comparative study of the various recommended certified rice seed varieties planted, their hectares and yields to ascertain farmers' varietal demand preferences in order to increase their adoption.

(ii) There is the need for periodic study of adoption rate for certified rice seed technology in the state in order to increase adoption among farmers.

(iii) There is the need to study the impact of existing agricultural input policies with a view to proffering lasting solutions to the persisting problem of inadequate and irregular supply of agricultural inputs to farmers.

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APPENDIX

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Factors affecting the adoption of recommended certified rice seed technology by farmers in four Local Government Areas in Kaduna State, Nigeria

QUESTIONNAIRE

A. Background Data

i. Name of Respondent ----------

ii. Name of Village ----------

iii. Local Government Area ----------

B. Socio- Economic Characteristics of Farmers

1. Age ----------years

2. Sex a. Male ( ) b. Female ( )

3. Martial Status :a. Married ( ), b . Single ( ) c. Widowed ( ) d Divorced. ( )

4. Educational level (number of years of formal schooling)

   a. No Formal Education ( )

   b. Primary ( )

   c. Secondary ( )

   d. Tertiary ( )

5. Total Farm size ----------Ha

6. How did you acquire your farmland?

   a. Inheritance ( )

   b. Purchase ( )

   c. Gift ( )

   d. Hire ( )

   e. Borrow ( )

7. Which major crops do you grow on your farm? (please list them).

   a. _____

   b. _____

   c. _____

   d. _____

8. Are you a member of any social groups or organizations ?

   Yes ( ) No ( )

9. If Yes, name the social groups or organizations .

   _____

   _____

10. What office do you hold in the social groups/organization?

    _____

11 Are you in any of these groups?

   (a)Village Council Yes ( ) , No ( )

   (b) Group farming Yes ( ) , No ( )

12 If yes, what office do you hold?_____

13. Did you have access to farm credit facilities last year (2011)?

   Yes ( ) No ( )

14 If Yes, what was the source/sources of your credit facilities? (multiple answers can be chosen).

   a. Relations and Friends ( )

   b. Money lenders ( )

   c. Social group/organization ( )

   d. Bank ( )

   e. Agricultural Agencies ( )

f. Others (Specify) ----------

15 In What form did you receive the credit facility?

a. Cash ( )

b. Farm inputs ( )

c. Others (Specify) ----------

16. If it was cash you received, what was the total amount? ₦_____

17. If it was farm inputs received, please list them and their values.

	Input type	Value (Naira)
a.	_____	_____
b.	_____	_____
c .	_____	_____

18. If you did not borrow, give reasons

a. I had sufficient money ( )

b . I don't like borrowing ( )

c. I tried to borrow but could not succeed ( )

d. The procedures were difficult ( )

e Others specify ----------

19. Do you have contacts with an extension worker in 2011?

Yes ( ) No ( )

20. If Yes, how many times did you have contact with him in the last farming season (2011)? _____

C. Sources of Certified rice seeds and other farm inputs

21. Are you aware of rice seeds from seed companies? Yes ( ), No ( )

22. If Yes, through which of these sources were you aware of certified rice seeds?(multiple answers can be chosen).

a. Extension workers ( )

b. Demonstration Plot ( )

c. mass media ( )

d. Seed sales agents ( )

e. Farmers and Friends ( )

f. Others (specify) ----------

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23. Do you use certified rice seeds? Yes ( ) No ( )

24. If you do not use certified rice seeds, which of these reasons are responsible?

a. Not interested ( )

b. Too expensive ( )

c. Not available in my area ( )

d. Others (specify) ----------

25. If yes, to 23 above, which year did you begin using certified rice seeds?_____

26. Among the following, who or what motivated you into using certified rice seeds? (multiple answers can be chosen).

a. Extension workers ( )

b. Friends/Farmers ( )

c. Demonstration plot ( )

d. Radio ( )

f. Local/Opinion leaders ( )

g. Others (specify) ----------

27. Which of these recommended certified rice seed varieties did you use in 2011?

a. NERICA d .ITA 150

b .FARO 44 (Sippi rice) e. Others (specify) ----------

c. FARO 52 (wita 4)

28. Where do you normally get your recommended certified rice seeds and other farm inputs? (tick the sources where applicable)

	Input	Government agencies	Dealers/ Agents	Seed companies	Open markets	Credit sources	Others (specify)
I	Certified seeds						
Ii	Herbicides						
Iii	Insecticides						
Iv	Fungicides						
V	Animal Traction						
Vi	Tractors						
Vii	Sprayers						
Viii	Axes, Hoes, Cutlasses						

ix Others(specify)__Fertilizers_____

29. Do you have rice seed agents or dealers in your locality?

Yes ( ) No ( )

30. Is your seed delivery system regular? Yes ( ) No ( )

31. What is the distance between your residence and your rice seed source? ……km

32. Do you think the distance between your residence and rice seed source have affected your certified seed demands? Yes ( ) No ( )

33. If yes, in which of these ways has distance affected your rice seed demands? (multiple answers can be chosen).

a. High cost of transportation ( )

b Constrained by long distance travelling ( )

c Leaving my farm unattended in order to travel ( )

d Others(specify)_____

34. Are you aware that recommended certified rice seeds have to be combined with other recommended crop management technologies?

Yes ( ), No ( ).

35 If Yes, which of these recommended agronomic practices are you aware of?

(please tick Yes or No, from below, the recommended agronomic practices that you are aware).

Awareness of the recommended agronomic practices in the technology
i. Are you aware of any of these recommended certified rice seeds? Upland Rice: NERICA, ITA 150.Lowland Rice: FARO (Sippi rice), Faro 52 (Witta 4) and Swamp rice: Faro 15.
ii Are you aware that the recommended seed treatment is to use Apron plus at the rate of 1 satchet to 3kg of seeds?
iii. Are you aware that the recommended Planting date for rice is June- mid July?
iv. Are you aware that the recommended plant spacing is to plant on flats 20cm x 20cm (for both transplanted and direct seeded rice)?
v. Are you aware of the following recommended Timely weed control measures? - Plough, harrow and level properly - Manual weeding -2-3weeks after sowing and 4-6weeks later. - Herbicide weed control – use Pendilin 500EC at the rate 1.5-2 litres/Ha as pre-emergence. Use Orizo EC as post-emergence at the rate of 4-6litres/ Ha. supplementary hand pulling of weeds is necessary
vi. Are you aware of the following recommended Fertilizer application? Basal Application- Apply 500kg (10bgs) N:P:K 15:15:15/Ha 3weeks after sowing. Top Dress using 100kg (2bags) urea/Ha. before panicle initiation.
vii. Are you aware of the following recommended Pests and Disease control measures? Use fungicides (Benlate) at the rate of 1kg/Ha to control fungus diseases. Use Best Action

or Uppercolt at the rate of 1litre/Ha to control sucking bugs and grasshoppers.
viii. Are you aware that the recommended timely harvest is when 80% of grains on panicles are straw coloured?

D Extent of Adoption

36 Which of the following recommended agronomic practices are you using? (please tick Yes, if adopted and No, if not adopted.

Recommended agronomic practices in the technology	Yes	No
i Did you use any of these recommended rice certified seeds? Upland Rice: NERICA, ITA 150.,ITA 257. Lowland Rice: Faro 27 (Sippi rice), Faro 44, Witta 4. Swamp rice: Faro 15 .		
ii Did you use the recommended Seed treatment, dressing seeds with Apron plus at the rate of 1 satchet to 3kg of seeds ?		
iii. Did you use the recommended planting date of June- mid July?		
iv Did you use the recommended plant spacing of planting on flats 20cm x 20cm (for both transplanted and direct seeded rice)?		
v. Did you use the recommended timely weed control measures as follows? - Plough, harrow and level properly - Manual weeding: 2-3weeks after sowing and 4-6weeks later. - Herbicide weed control : use Pendilin 500EC at the rate 1.5-2 litres/Ha as pre-emergence. Use Orizo EC as post-emergence at the rate of 4-		

6litres/ Ha. Supplementary hand pulling of weeds .		
vi. Did you use the following recommended Fertilizer Application? Basal Application- Apply 500kg (10bgs) N:P:K 15:15:15/Ha 3weeks after sowing. Top dress – by applying 100kg (2bags) Urea/Ha. before panicle initiation		
vii. Did you use the following recommended pests and diseases control measures? Use fungicides (Benlate) at the rate of 1kg/Ha To control Furgus diseases, use Best Action or Uppercolt at the rate of 1litre/Ha to control sucking bags and grasshoppers.		
viii. Did you harvest at the recommended time, when 80% of grains on panicles are straw coloured?		

37. Score the following statements with regards to the technological attributes of the recommended certified rice seed technology as experienced by you. (please tick in the box of your choice).

TECHNOLOGY ATTRIBUTES	**Ratings**	**Scores**
Relative Advantage: The technology has relative advantage	Strongly agree (5)	
	Agree (4)	
	Undecided (3)	
	Disagree (2)	
	Strongly disagree (1)	
Compatibility; The technology is compatible with existing ideas , beliefs and practices:	Highly compatible (5)	
	Compatible (4)	
	Undecided (3)	
	Incompatible (2)	
	Highly In Compatible (1)	
Complexity: The technology is complex and relatively difficult to follow	Easy (5)	
	Relatively easy (4)	
	Undecided (3)	

	Complicated (2)
	Highly complicated (1)
Trialability: The technology can be tried	Highly trialable (5)
	Trialable (4)
	Undecided (3)
	Not trialable (2)
	Highly not trialable (1)
Divisibility : The technology can be divided into parts	Highly divisible (5)
	Divisible (4)
	Undecided (3)
	Indivisible (2)
	Highly indivisible (1)

38 Which of these problems did you notice with the certified rice seeds used? (multiple answers can be chosen).

(a) Adulteration ( )

(b) Poor germination and vigour ( )

(c) Broken seeds ( )

(d) Others (specify)_____

39. How would you rate the quality of the recommended certified rice seeds used? (tick where applicable under each crop) .

	Maize	Rice	Sorghum	Cowpea
a High	( )	( )	( )	( )
b Moderate	( )	( )	( )	( )
c Low	( )	( )	( )	( )

d Others(specify)_____

40. Did you encounter any problems in the adoption of the recommended agronomic practices? Yes ( ), No ( )

41. If Yes,did you encounter any of the stated problems below? Please write either Yes or No, under each crop where applicable.

	Problems	Maize	Rice	Sorghum	Cowpea
A	Inputs supply is not regular				
B	Poor timing of input supplies				
c	Expired inputs				
D	Poor access to credit facilities				
E	Extension staff are not sufficient				
F	Input costs are high				
g	Tractors and impliments are inaccessible				
h	High cost of manual labour				
.					
I	Others, (specify)_____				

E Observed Effects

42. a. What was the farm size (in Ha) planted with rice seeds before and after using certified seeds?

Crop	Farm size (in Ha) in the year before using certified seeds	Farm size (in Ha) in 2011 using certified seeds	Difference in Ha.
Rice			

b What were the yields obtained ?

Crop	Yield (in kg) before using certified seeds	Yield (in kg) using certified seeds in 2011	Difference in kg
Rice			

C What quantity of rice did you keep for consumption?

Crop	Quantity kept (in kg) before using certified seeds	Quantity kept (in kg)after using certified seeds in 2011	Difference in kg
Rice			

E Observed Effects

42. a. What was the farm size (in Ha) planted with rice seeds before and after using certified seeds?

Crop	Farm size (in Ha) in the year before using certified seeds	Farm size (in Ha) in 2011 using certified seeds	Difference in Ha.
Rice			

b What were the yields obtained ?

Crop	Yield (in kg) before using certified seeds	Yield (in kg) using certified seeds in 2011	Difference in kg
Rice			

c What quantity of rice did you keep for consumption?

Crop	Quantity kept (in kg) before using certified seeds	Quantity kept (in kg)after using certified seeds in 2011	Difference in kg
Rice			

d. What was the market price/kg in naira (₦) of the yields?

Crop	price/kg in (₦) before using certified seeds	price /kg in (₦) in 2011 after using certified seeds	Difference in (₦)
Rice			

e. What was the income realized (in naira) from the sale of rice?

Crop	Income realized from yield before using certified seeds(in ₦)	Income realized from yield in 2011 after using certified seeds in ₦	Difference in ₦
Rice			

f Which of the following items or materials were you able to purchase with the income realized from the sale of rice the year before using certified seeds and the year 2011 after using certified seeds? (please write item and quantities or cash in (₦) , where applicable)

Items/materials	Year before using certified seeds	Year 2011 using certified seeds	Difference
Children' education			
Provision of foodstuff			
Improved healthcare			
Adequate clothing			
Zinc roofs			
Motorcycle			
Bicycle			
Radio			
Work Bulls			
Irrigation pumps			

Cattle			
Sheep			
Goats			
Fowls			
Pigs			
Television set			
Houses			
GSM Handsets			
Savings			
Grinding machines			
Electric Generators			
Social Status			

Others

(specify)_____

43 Are there other benefits associated with adoption of certified seed technology?

Yes ( ), No ( )

44 If Yes, which of these do you agree are the benefits? Please tick Yes or No

	Yes	No
a. Improved farm management skills	( )	( )
b. Improved food security to my household	( )	( )
c. Working in groups	( )	( )
d. Farm record keeping	( )	( )
e. Improved social life	( )	( )

Others (specify)_____

45 Constraints to adoption

. Among the following, what are the major constraints associated with the adoption of certified seed technology? (tick Yes or No, from the list below).multiple choice

	Constraints	Yes	No
I	Unavailability of recommended inputs		
Ii	Lack of access to credit facilities		
Iii	Input adulteration		
Iv	Lack of continuous sources of input supplies		
V	Limited knowledge of recommended technologies		
Vi	Lack of sufficient funds		
Vii	Others(specify)		

46. Give suggestions on how to improve the adoption of recommended certified rice seed agronomic practices in your area. ----------

THANK YOU.