ADOPTION OF IMPROVED MAIZE AND CASSAVA TECHNOLOGY PACKAGES BY FARMERS IN NKANU EAST AND WEST OF ENUGU STATE, NIGERIA

BY

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY, FACULTY OF AGRICULTURE, AHMADU BELLO UNIVERSITY, ZARIA.

DECEMBER, 2011

DECLARATION

I hereby declare that this thesis titled "Adoption of Improved Maize and Cassava Technology Packages by Farmers in Nkanu East and West of Enugu State, Nigeria" was written by me and it is a record of my own research work. It has not been presented before in whole or in part for a higher degree. All referred ideas have been duly acknowledged by means of references.

_____ _____

Ede Douglas Emmanuel Date

CERTIFICATION

This thesis titled "Adoption of Improved Maize and Cassava Technology Packages by Farmers in Nkanu East and West of Enugu State, Nigeria" by Ede, Douglas Emmanuel, meets the regulations governing the award of the Degree of Master of Science (M.Sc.) in Agricultural Extension and Rural Sociology of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my darling wife, Mrs. Uche Veronica Ede and my lovely children: Obinna, Chioma, Amaka and Ugochukwu for their encouragement and prayers.

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ABSTRACT

This study was conducted in Nkanu East and West Local Government Areas of Enugu State, Nigeria, with the key objective to determine adoption of improved maize and cassava technology packages by farmers in the area. Data for the study were collected in 2008-2009 cropping season using 120 farmers randomly drawn from the two LGAs. The results on the main sources of information used by the farmers revealed that 84.40% of them used radio, while 73.69% of them used television. Households consisting of 6-10 persons per household constituted 63.33%, 51.67% of the respondents owned land of 1-3ha per farm household, while about 51.67% of them had between 8-14 years' farming experience and 44.20% of the farmers belonged to 3-4 social organizations per person. Findings further showed that 52.50% of the farmers had only 3 times contact with extension agents in the preceding year of this study while 94.17% of the farmers listen to agricultural programmes on radio. Compatibility and complexity attributes received 72.50% and 81.67% affirmations respectively by the farmers. Between 2004-2005 and 2008 – 2009 seasons, awareness and adoption rates rose gradually from 7% – 28% while 84.17% of the respondents assented to having adopted the improved cultivars. Although Pearson product moment coefficient of correlation and regression results revealed that factors such as household size, farm size, group membership mass media exposure and extension contact, compatibility and complexity were related to adoption at $p<.05$ and $p<.01$, the major determinants of adoption were group membership, mass media exposure and compatibility at $p<.05$, while extension contact, farming experience and complexity were at $p<.01$. Effects of adoption on farmers' production, income and perceived individual well-being showed increases from mean production level of 4.57 tonnes per ha before adoption to 5.16 tonnes per ha after adoption, mean income level from ₦13,875.41per ha before adoption to ₦16,412.92 per ha after adoption and mean scale value of contentment from 2.43 before adoption to 3.20 after adoption. Given that 91.67% of the farmers expressed dissatisfaction with lack of access to inorganic fertilizers, 75.00% of the respondents complained of lack of tractors for hiring and 62.50% of the farmers protested shortage of improved maize seeds and cassava stems, among others, the study recommends that a concerted effort be made by ENADEP and Enugu State Government to address the problems of the farmers in the area. Such intervention will no doubt enhance adoption potential of improved maize and cassava technology packages in the area and beyond.

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ACRONYMS

ADP:	Agricultural Development Project
CTA:	Technical Centre for Agricultural and Rural Cooperation
ENADEP:	Enugu State Agricultural Development Project
FAO:	Food and Agriculture Organization`
GSM:	Global System of Mobile Communication
Ha:	Hectare
IAR:	Institute for Agricultural Research
IFAD:	International Fund for Agricultural Development
LGA:	Local Government Area
MAP:	Months After Planting
NAERLS:	National Agricultural Extension and Research Liaison Services
NARP:	National Agricultural Research Project
NATSP:	National Agricultural Technology Support Programme
NGO:	Non-Governmental Organization
PPP:	Public Private Partnership
T & V:	Training and Visit
WAP:	Weeks After Planting

CHAPTER 1

INTRODUCTION

1.1 Background to the Study

The production of food and fibre to satisfy the world population is critical to the socio-economic well-being of all societies. Unless agricultural produce and products are plentiful and relatively inexpensive, in both urban and rural collectivities, the life chances of human populations are significantly reduced. In the United States of America as well as other developed nations of the world, the productivity of agricultural sector has been consistently high for decades (Camboni and Napier, 1993). As a major source of economic buoyancy, those countries have over the years placed high values on agriculture by making generous budgetary provisions to the sector, particularly in the areas of research and extension activities. Consequently, several studies on adoption – diffusion of innovations aimed at boosting farm productivity have been conducted which have largely translated into their present self-sufficiency in food production.

Some of the studies according to Rogers (1962) included: congruence versus profitability in the diffusion of hybrid sorghum (Brandner and Straus, 1959); The adoption of two farm practices in a Central Iowa Community (Beal and Rogers, 1960); Adoption of new ideas and practices (Lionberger, 1960); Farm practice attributes and adoption (Fliegel and Kilvin, 1961); Diffusion of innovations (Rogers, 1962); and Farmer practices and problems in Northern Veracruz (Harrington, 1979).

Almost all farmers have a goal of increasing income. Also small farmers have a security goal of meeting subsistence requirements of their preferred foods. Despite

that, as much as they may wish to adopt new technologies, they equally want to avoid taking risks that might jeopardize their subsistence or sources of income.

World Bank (1999) reported Nigeria's annual agricultural growth rate at 2.9%. Juxtaposed against its current annual population growth of 3%, it casts a dark shadow over its capability to produce enough food for its growing population, which outstrips food production. This accounts for the current food crisis facing the nation coupled with a negative impact on the economy and low levels of production and investment in the sector.

On their own part, Nigerian agricultural scientists rose up to the challenge by embarking on appropriate research efforts that resulted in the introduction of new technologies that are fast transforming and modernizing the Nigerian agricultural landscape. Similarly, adoption – diffusion scientists executed studies in their effort to identify problems associated with adoption or rejection of innovations (e.g. National Agricultural Extension Research and Liaison Services – NAERLS, 2000; Adekoya and Ajayi, 2000; Atala, 1986) and others. However, in an attempt to solve the problem of agricultural extension under the Ministries of Agriculture, the Agricultural Development Projects (ADPs), based on the training and visit (T and V) extension management system that integrates extension workers' training, farm visits, and ensures a two-way communication between research and farmers, and an effective inputs distribution system, was introduced in the 1980s but perceived to have been largely ineffective due partly to slow implementation (Olayide *et al.*, 1980; Madukwe, 1989 and Eziakor, 1990).

1.2 Statement of the Problem

Diverse motives abound why farmers adopt or reject agricultural innovations. These factors may include social, psychological, institutional and technological, as well as farmers' characteristics and attributes of the innovations. In 2004-2005 cropping season, the Enugu State Agricultural Development Programme (ENADEP) introduced improved maize and cassava technology packages in Nkanu East and West of Enugu State, Nigeria. However, up till date there is insufficiency of empirical evidence showing the extent to which farmers have adopted the technology packages, or indeed where the farmers are on the adoption continuum. It is against this backdrop that the present study on adoption of improved maize and cassava technology packages by farmers in the study area was conceived and executed. It was hoped that the knowledge to be obtained there from would be utilized to fast-track the agricultural transformation and modernization of the area by way of technology adoption for increased food production. Factors that encourage people to change their activities and attitudes and the goods they purchase are of interest to many disciplines and people. According to Ekong (1995) information of those factors when accurately compiled is invaluable for development planning purposes.

The study therefore sought answers to the following research questions:-

i. What are the main sources of information on improved maize and cassava technology packages used by farmers in the study area?

ii. What are the factors affecting farmers' adoption of improved maize and cassava technology packages, in relation to innovation attributes, in the study area?

iii. What are the rates and levels of awareness of improved maize and cassava technology packages among farmers in the study area?

iv. What are the rates and levels of adoption of improved maize and cassava technology packages in the study area?

v. What are the relationships between the factors, in relation to innovation attributes, and farmers' adoption of improved maize and cassava technology packages in the study area?

vi. What are the effects of adopting the technology packages on the farmers' production, income and perceived individual well-being in the study area?

vii. What are the constraints to adoption of the improved maize and cassava technology packages by farmers in the study area?

1.3 Objectives of the Study

The key objective of the study was to determine the factors, in relation to innovation attributes, affecting adoption of improved maize and cassava technology packages by famers in the study area. The specific objectives were to:

i. identify the main sources of information on improved maize and cassava technology packages used by farmers in the study area;

ii. identify the factors affecting adoption of improved maize and cassava technology packages by farmers, in relation to innovation attributes, in the study area;

iii. describe the rates and levels of awareness of improved maize and cassava technology packages by famers in the study area;

iv. assess the rates and levels of adoption of improved maize and cassava technology packages among farmers in the study area;

v. describe the relationships between the factors, in relation to innovation attributes, and adoption of improved maize and cassava technology packages in the study area;

vi. determine the effects of adoption of the technology packages on farmers' production, income and perceived individual well-being in the study area;

vii. ascertain constraints to adoption of improved maize and cassava technology packages by famers in the study area.

1.4 Justification of the Study

Several studies have been conducted on diffusion-adoption of innovations in Nigeria. These included: Kidd, (1968); Patel and Anthonio (1971); Voh (1982); Atala (1998); Musa (1998); Akpoko (2004) and Igbokwe and Adebayo (2005). The above list is by no means exhaustive, hence more adoption research is still required.

It is in this context that the present study was carried out in the study area so as to determine which factors aid or hinder adoption of the technology packages. This is with a view to reinforcing those favourable factors in order to ensure sustainable utilization of the innovations in the future. Those factors and innovation attributes found to hinder adoption could then be reappraised by future researchers as appropriate, especially as available evidence indicates that the area is at the present time under-researched. Other aspects of the study to be inquired into include: identifying the main sources of information on the technology packages used by farmers in the area, describing the prevailing rates and levels of awareness

and adoption, as well as determining the effects of adoption on the farmers' production, income and perceived individual well-being and finally ascertaining any constraints thereto.

It is hoped that the benefits to accrue from the study will enhance the robustness of adoption research in Nigeria, particularly in the south-east agro-ecological zone. Above all, it will provide researchers, extension agents and other stakeholders insights to attract to the area successful interventions by government agencies, Non-governmental Organizations (NGOs), Public Private Partnerships (PPP), and international agencies (e.g. Food and Agriculture Organization-FAO and International Fund for Agricultural Development-IFAD, among others), especially by way of technical assistance.

1.5 Hypotheses of the study

The following hypotheses were tested in null form ($H_o = r_{xy} = O$)

i. There is no significant relationship between factors affecting adoption and farmers' adoption behaviour.

ii. There is no significant relationship between innovation attributes and farmers' adoption behaviour.

iii. There is no significant relationship between farmers' adoption behaviour and production, income and perceived individual well-being of the farmers.

CHAPTER 2

LITERATURE REVIEW

2.1 Rural Development and Agricultural Extension

2.1.1 Rural Development

Rural development as a broad concept is the process of improving the socio-economic conditions of people who reside in the rural areas (Youdeowei *et al.,* 1986). It entails the structuring and restructuring of the economy in order to satisfy the material needs and aspirations of the rural masses as well as promoting individual and collective incentives to participate in the process of development. This process involves a host of multi-sectoral activities including the improvement of agriculture, promotion of rural industries, poverty reduction, creation of requisite infrastructure and social overheads and establishment of appropriate decentralized structures in order to allow mass participation (Idode, 1989).

Many rural development models represent a synthesis between western or external approaches and local or internal approaches (e.g. technology transfers). As these may sometimes be in conflict, recourse to such paradigmatic micro-level adoption/diffusion studies as this may be conducted where factors or characteristics of farmers that affect adoption of specific innovations could be identified and analyzed. Solutions may then be proffered to boost the living conditions of the clientele given that development as a concept is normative, value-loaded and almost synonymous with improvement (Schaff, 1970 and McCranaham, 1972).

2.1.2 *Agricultural Extension*

The role of extension in agricultural development involves improvement in the performance of people engaged in primary production. Higher levels of production efficiency are undertaken in order to enhance per capita income, quality of life and overall welfare. As an informal type of education, it is given to farmers so that they can improve their farming operations. Its main goal is to transmit the required information to the larger number of people within the shortest possible time.

Agricultural extension services and programmes have developed around a philosophy-helping farmers help themselves in the identification and solution of their farm and home problems *(*Youdeowei *et al.,* 1986*)*. In a predominantly subsistent rural agriculture, the small-scale farmers are handicapped in dealing with their individual family problems. More so neighbouring farmers are all experiencing similar problems, hence cannot be of much assistance to one another. There is little challenge, hope or encouragement within the environment to assist the farmer. This scenario therefore results in apathy and erodes an individual farmer's capability to find solutions dispassionately.

Unfortunately, despite all the innovations introduced over the years, the output from the system has continued to dwindle as studies have shown. The objectives of past and present/ongoing agricultural extension and rural development programmes in Nigeria though laudable, the problems of food and fibre shortages still persist because among other things, the extension system has been very weak and ineffective (Ekpere, 1973, Madukwe, 1989 and Emefie, 1991).

Williams (1978) and Olayide (1986) observed that the Ministry of Agriculture extension service has proved ineffective because the implementation of its

programmes has been characterized by unnecessary bureaucracy with little emphasis on research- extension-farmer linkage. A similar view was expressed by Eziakor (1990) when he noted that implementation holds a key to achieving the goals of any extension organization. Effective implementation is therefore *sine qua non* for the success of overall agricultural development schemes. In its own contribution to draw attention to the issue, the World Bank (1990) maintained that the basic function of extension is to enhance the capacity of farm families to deal with their problems and meet new opportunities through information transfer.

2.2 Adoption Process

Adoption is about decision to continue full use of an innovation. It is a mental process through which an individual passes from first hearing of an innovation to final adoption of same. As Rogers, and Shoemaker (1971) did observe, adoption process is affected by the following major factors:

i. Socioeconomic status;

ii. Personality variables;

iii. Communication behaviour, among others.

Rogers (1962) maintained that the actor's identity and his perception of the situation affect his adoption behaviour. This comprises of his sense of security, his dominant values, his mental ability and conceptual skill, social status and his cosmopoliteness as well as the social system's norms on innovativeness, its economy and the unit's characteristics.

Consequently, efforts have been directed towards farmers' awareness of certain recommended agricultural inputs and new practices and making these accessible to farmers and persuading them to adopt the new inputs and practices.

2.2.1 Stages of Adoption

Rogers (1962) outlined the following five stages of adoption and their main functions in the adoption process:

i. Awareness stage (ii) Interest stage (iii) Evaluation stage (iv) Trial stage (v) Adoption stage.

i. ***Awareness Stage***: The individual is exposed to the innovation but lacks complete information about it. The primary function of the awareness stage is to initiate the sequence of later stages that lead to eventual adoption or rejection of the innovation.

ii. ***Interest Stage*****:** At the interest stage the individual becomes interested in the new idea and seeks additional information about it. The individual favours the innovation in a general way, but he has not yet judged its utility in terms of his own situation. Its main function is to increase the individual's information about the innovation, even as he becomes more psychologically involved in the innovation.

iii. ***Evaluation Stage*****:** At the evaluation stage the individual mentally applies the innovation to his present and future situations, and then decides whether or not to try it. If the individual feels that the advantages of the innovation outweigh the disadvantages he will try the innovation.

iv. ***Trial Stage*:** At the trial stage the individual uses the innovation on a small scale in order to determine its utility in his situation. Its main function is to demonstrate the new idea in the individual's own situation so as to judge its usefulness for possible complete adoption. The individual may seek specific information about the method of using the innovation at the trial stage.

v. ***Adoption Stage*:** At the adoption stage the individual decides to continue the full use of the innovation. The main functions of the adoption stage are consideration of the trial results and the decision to ratify sustained use of the innovation in the future.

2.2.2 Adopter Categories: Based on the time taken to adopt an innovation, researchers have classified adopters into various categories as follows:

(i) Innovators; (ii) Early Adopters; (iii) Early Majority; (iv) Late Majority; (v) Laggards (Rogers and Shoemaker, 1971).

2.3 Socio-economic Factors Affecting Adoption of Innovations

This section will now review some of the previous works already done on some socio-economic factors affecting adoption of innovations by farmers. Such factors include level of formal education, income, cosmopoliteness, membership of associations, household size, age and social status. Voh (1979) and Atala (1980) discovered that socio-economic factors like age, household size, formal education, income, cosmpoliteness and community status were related to adoption. They equally found that non-adopters were older than adopters. Akanya (1989) also concluded that certain socio-economic variables were severally related to adoption of agricultural innovations.

Furthermore, Ekenta (2004) citing Nweke and Akerhe (1993) stated that adoption of improved technologies is influenced by certain factors and is a function of farmers' characteristics, extension agency and the new technologies themselves as material components.

Similarly Awogbade (1981) posited that due to family/village structural arrangement in which the head of household acts as both the legal and political spokesperson on all issues, his decisions often influence others to either adopt agricultural innovations or not. Onazi (1973) in his inquiry of Northern Nigeria found inter-alia certain reasons for farmers' non-adoption of agricultural practices as reluctance to give up their old ways and unfavourable producers' prices. By and large, farmers' response to agricultural innovations is attributable to a number of institutional and national economic and environmental factors viz credit, extension agent, input delivery, land tenure and sources of information. Patel and Anthonio (1971), Akinola (1986a), Okwoche *et al.,* (1998) established positive relations between farmers' adoption behaviour and access to credit, while Akinola (1986b) attested same for product prices, quantity of inputs available for sale, number of active selling points and advertisement. Similarly, for such communication factors as period of awareness and cosmopolitanism, Onu (1985), Amotsuka (1988), Agbamu (1993), Umeh (1998) and Ladebo (1994) equally concurred.

Iyere (1985), Ngwu (1989), Adebayo (1994), Akinola (1986a), Vabi et al (1993), Adekoya and Ajayi (2000), Agbamu (1993), Musa (1998), Umeh (1998), Akinola (1986b), Asifat (1986) and Chukwu (1995) proved negative relations between household/family size, membership of cooperatives, social position/cultural positioning, extension agent contact, cost of innovation and difficulty in use of innovation and adoption behaviour. Mijindadi and Njoku (1985) in a study to

assess the extent to which tomato innovations were adopted in cooperative and individual farms in Ikara area of Zaria found significant associations between extension contact, membership of associations, credit availability and input delivery and farmers' awareness and adoption of horticultural innovations.

2.4 Theoretical Framework

Perspectives on theories of adoption and diffusion formed the basis of analysis of this study.

2.4.1 *Adoption Theories*

Adoption theory in agriculture essentially sees the adopt/reject decision as a 'risky choice' problem. The decision to adopt a new innovation is risky because the farmer is unsure whether he/she will be better or worse by adopting. The likelihood of making a correct, or incorrect decision clearly depends on the decision maker's knowledge of the relevant parameters - the more that is known the less likely it is that an incorrect decision will be made. Adoption is essentially a process of collecting information, revising opinions/attitudes and reassessing decisions. Thus it is a dynamic learning process. Conventional research into farmer adoption of new technologies describes adoption-decision and its timing, (early or late) primarily in terms of the decision maker's perception and inherent characteristics, with innovator at one extreme and laggard at the other (Rogers, 1995).

However, the notion that the decision to adopt or reject an innovation depends on what is in the producer's best interest is deceptively simple. Pannel (1999) acknowledges this when he said "we can identify the conditions necessary to

achieve adoption of an innovation but it remains difficult to meet those conditions". He further listed these conditions as:

(a) Awareness of the innovation

(b) Perception that it is both feasible and worthwhile trialing the innovation; and

(c) Perception that the innovation promotes the farmer's objectives.

a. Risk and Uncertainty in Adoption

Just and Zilberman (1983) were among the first to propose a theory of technology adoption under uncertainty using the expected utility framework. Their model is an extension of the original Baron (1970) and Sandmo (1971) expected utility approach to producer behaviour under uncertainty. This approach provides a theoretical basis for study of the role played by firm size, risk attitudes and the joint distribution of returns, credit constraints, and fixed costs of adoption in the choice between two risky technologies. One theoretical result of their model is that when the covariance of returns between the old and new technologies is high and the decrease in absolute risk aversion as wealth increases is sufficiently large, there may be a limit to the proportion of a farmer's cropland devoted to a new, profitable technology.

b. *Empirical Studies Accounting for Risk and Uncertainty in Adoption*

On the relationship between the riskiness of the technology and the utility of a risk-averse decision maker, Marra *et al.* (1987) reported that there is a general scarcity of empirical studies that have adequately addressed the role of risk and uncertainly in adoption. Feder *et al.* (1985) in their review of the adoption

literature attributed this scarcity to difficulties in observing and measuring risk and uncertainty, as noted by Lindner et al. (1982) and Akinola (1986).

Smith and Mandac (1995) estimated farmers' subjective probabilities of the distribution of yields through a direct elicitation technique. They then compared these estimated probability distributions to relatively objective estimates. Their results showed that while the means of subjective and objective distributions were similar, farmers seriously underestimated variances when compared to more accurate estimates of objective variances.

c. Typology of Empirical Adoption Studies

Lindner's (1987) survey of research on adoption at the firm level found that most studies were concerned with identifying those characteristics of the adopters or the innovations that influenced adoption decisions. He classified these empirical studies into two categories. The first were the cross-sectional studies in which the main question was why do some producers adopt an innovation while others reject it? The majority of the empirical studies of adoption are concentrated in this category. Recent examples include Shapiro *et al.* (1992), Bosch *et al*. (1995), Nkonya *et al.* (1997) and Marra *et al.* (2002).

The second type of adoption studies is the temporal studies that are concerned with the determinants of the timing of adoption. Marra *et al.,* (2002) observed that these studies typically try to identify why some producers are early adopters while others are laggards.

d. Interdisciplinary Perspectives on Adoption of New Technologies

Reviews of adoption and diffusion studies with an historical slant can be found in Rosenberg (1976), Lindner and Pardey (1979), Lindner (1987), Grubler (1992),

Ruttan (1996) and Sarkar (1998). Sociologists and economists have been the main contributors to the conceptualization of the adoption decision process at the individual firm level. Sociologists have traditionally concentrated on the distinguishing characteristics of the potential adopters and opinion leaders, prospective adopter's perception of the attributes of innovations, rates of adoption of new technologies and ideas, and finally the communication channels involved in the different stages of the innovation-decision process. Ruttan (1996) commented that a positive aspect of the limited, but valuable, convergence of the application of methodologies from economics and sociology has been the identification of the learning behaviour of individuals as an important factor in the adoption process.

Griliches' research on hybrid corn in the USA was one of the first economic studies of adoption of rural innovations by economists (Griliches, 1957, 1960). Although not surprising, his conclusion that economic variables were the major determinants of technological change and adoption of innovations, it was path breaking at the time. Mansdfield (1961), who conducted contemporaneous empirical studies of adoption rates of a number of industrial innovations, also concluded that the adoption of innovations is determined by their economic attributes.

Ruttan (1996) reviewed a suite of studies that used what he referred to as equilibrium models of diffusion. He noted that in these models, diffusion is conceptualized as a transition between equilibrium levels, influenced by changing economic attributes (such as prices) and a changing environment (as crop yields). In these models, diffusion does not involve learning. Rather, diffusion occurs as a result of the interaction of changes in the innovation and adoption environment.

Therefore the process of technological change is one of substitution rather than a diffusion phenomenon.

e. Information Perspective on Adoption of New Technologies

To model the micro-level adoption process from a dynamic perspective, it is necessary to treat adoption as a process involving acquisition of information and learning. A survey of recent literature on the dynamics of the adoption innovation shows two distinct approaches to modeling this process. The first is to model the adoption decision of individuals over time by the inter-temporal changes in certain explanatory variables. For innovations that are "divisible" (for example a new crop) and can be adopted in a stepwise manner, the adoption decision also involves a decision regarding the intensity of adoption at any given time period along the adoption time path, (Marra *et al*., 2002)

Warner (1974) concluded that learning and imitation are central to the adoption story. He interpreted the specification of the logistic function for the diffusion of an innovation over time as implying that potential adopters initially have a cautious approach toward adopting the innovation. Where possible, they initially experiment with the innovation on a trial basis. Before deciding whether to adopt or not, they seek information on the cost and value of the innovation from their own and other users' experiments. As more information is gathered the decision-makes are able to increase their knowledge about the overall attractiveness of the innovation throu8gh improvement in their knowledge of the best use of the innovation and reduction in their uncertainty about its potential benefits. This in turn increases the pace of adoption. He asserted that the nature of learning and imitation has been embedded in the mathematical diffusion model both by assumption and by derivation. He argued that there was strong empirical evidence

for the hypothesis that efficiency in the use of a novel technology increases with experience (learning-by-doing). Linder and Pardey's (1979) conclusions supported this proposition.

2.4.2 Theory of Diffusionism

Diffusion is the process by which an innovation spreads from the source of its invention to the ultimate users or adopters. Whereas adoption process deals with adoption of a new idea by an individual, diffusion process deals with the spread of new ideas in a social system or the spread of innovations between social systems or societies (Rogers, 1995). Thus, diffusion of an innovation occurs within a social system which may embrace many situational fields. The segments of the social system in a study area under reference can influence individual farmers to display varying degrees of innovativeness, from innovators to laggards. Opinion leaders who are generally early adopters enhance diffusion of innovations, while late majorities and laggards hinder it.

Adoption – diffusion theory was the dominant approach in 1960s (Rogers 1995). Diffusion theorists accepted the products of agricultural research as wholly desirable. Hence, their work focused almost exclusively on the fate of innovations designed for farm use. They employed a communications' model adopted from engineering in which messages were seen to be transmitted from sender to receiver, later adding the engineering term "feedback" to describe receivers' responses to the massage sent to them. They argued that adoption could be best understood as based on the psychosocial characteristics of adopters and non-adopters. Early adopters were found to be more cosmopolitan, better educated, less risk averse, and more willing to invest in new technologies than late adopters, pejoratively labelled 'laggards'.

As Rogers further points out, diffusion is not a single all-embracing theory. It is several theoretical perspectives that relate to the overall concept of diffusion; it is a metatheory. The work of Ryan and Gross (1943) on rural sociology is cited as the beginning of diffusion research. This used interviews as their main method of data collection. This has been a trend in diffusion research since. He further explains that there are four major theories that deal with the diffusion of innovations. These are the innovation – decision process theory, individual innovativeness theory, rate of adoption theory, and theory of perceived attributes.

a. Innovation-Decision Process Theory

The innovation-decision process theory is based on time and five distinct stages. The first stage is knowledge. Potential adopters must first learn about the innovation. Second, they must be persuaded as to the merits of the innovation. Third, they must decide to adopt the innovation. Fourth, once they adopt the innovation, they must implement it. Fifth, they must confirm that their decision to adopt was the appropriate decision. Once these stages are achieved, then diffusion results.

b. Individual Innovativeness Theory

The individual innovativeness theory is based on who adopts the innovation and when. A bell-shaped curve is often used to illustrate the percentage of individuals that adopt an innovation. The first category of adopters is innovators (2.5%). These are the risk-takers and pioneers who lead the way. The second group is known as the early adopters (13.5%). They climb on board the train early and help spread the word about the innovation to others. The third and fourth groups are the early majority and late majority. Each constitutes 34% of the potential adopting population. The innovators and early adopters convince the early majority. The

late majority waits to make sure that adoption is in their best interests. The final group is the laggards (16%). These are the individuals who are highly skeptical and resist adopting until absolutely necessary. In many cases, they never adopt the innovation

c. Theory of Rate of Adoption

The theory of rate of adoption suggests that the adoption of innovations is best represented by an s-curve on a graph. The theory holds that adoption of an innovation grows slowly and gradually in the beginning. It will then have a period of rapid growth that will taper off and become stable and eventually decline.

d. Theory of Perceived Attributes

The theory of perceived attributes is based on the notion that individuals will adopt an innovation if they perceive that innovation has the following attributes- must have some relative advantage over an existing innovation or the status quo in terms of superiority. Second, it is important the innovation be compatible with existing values and practices. Third, the innovation cannot be too complex.

Fourth, the innovation must posses divisibility.

This means the innovation can be tested for a limited time without adoption. Fifth the innovation must offer observable result with availability of the components assured.

2.4.3 *Elements of Diffusion*

Four key elements involved in diffusion of innovations are:

(1) The innovation

(2) Its communication from one person to another,

(3) Social system, and

(4) Time (Rogers; 1995).

Going by the literature reviewed, the importance of developing the rural areas by boosting the productivity of the farmers as well as ameliorating poverty and inequality within the social system cannot be underestimated. This is achievable through extension programmes such as diffusing appropriate technological innovations to a larger number of clients within the shortest possible time. The goal is the modernization of agricultural practice and transformation of subsistence agriculture to a commercial enterprise. This study is set to help accelerate adoption and continued adoption of the improved maize and cassava technology packages in the study area, in order to boost the living standard of people in the social system.

Conceptual Model

The conceptual model used for this study is as shown below:

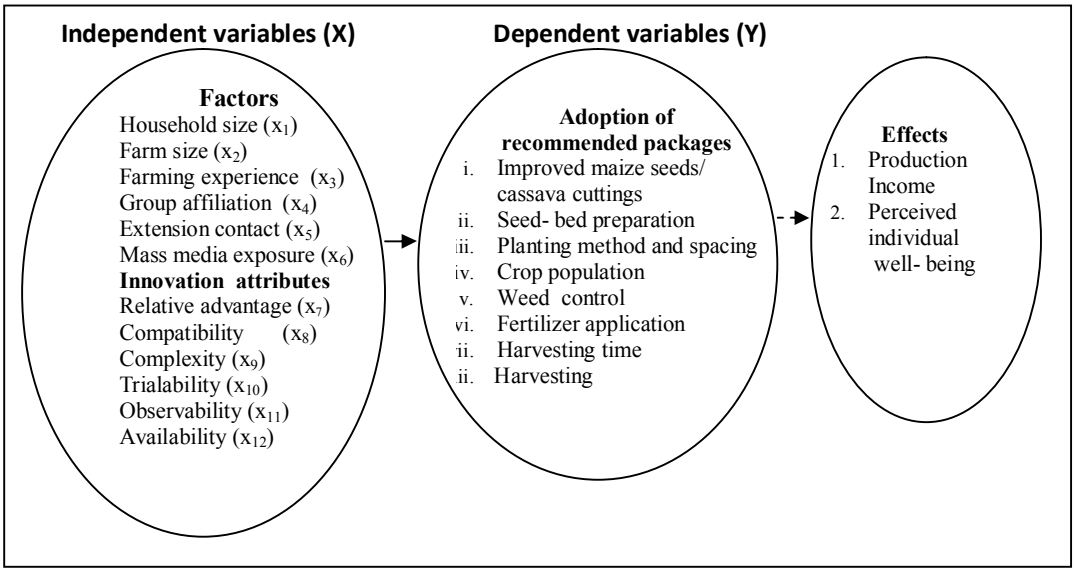


Figure 1: Conceptual model of factors affecting adoption of improved maize and cassava technology packages by farmers and effects.

CHAPTER 3

3.0 METHODOLOGY

3.1 Study Area

This study was carried out in Nkanu East and West Local Government Areas (LGAs) of Enugu State. Enugu State lies between latitudes O^0N and 7^0N of the Equator and longitudes 7^0E and 8^0E of the Meridian. It occupies an area of 8,730 square kilometres with a population of 3,810,878 people (by projection to 2011 from 3,257,298 on National Population Census, 2006). Created in 1991 from the eastern two – thirds of former Anambra State, Enugu State is one of the 36 states in the Nigerian federation and is located in South-East geopolitical zone of Nigeria. It is bounded to the north by Kogi and Benue States, to the east by Ebonyi, to the south by Abia and Imo and to the west by Anambra State (Widjaja, 2001).

The landscape changes from tropical dense rain forest in the south to small round-topped hills covered by open grasslands with savannah in the north. The state includes most of the Udi-Nsukka plateau, a pair of plateaus that forms a nearly continuous elevated area. The Nsukka Plateau extends about 130 kilometers from Nsukka in the north to Enugu southward for about 160 kilometers to Okigwe. It rises more than 300 meters and its highest point is found 20 kilometers northwest of Enugu. The steep slopes form spectacular views of the hills and lowlands, broken up by numerous streams and rivulets feeding the Niger and Benue rivers (Widjaja, 2001). It has rich agricultural and mineral resources. The weather is fairly equable. The mean temperature in the hottest period of February and April is about 87^oF. It is generally cold during the rains (May to October) and hot in the

dry season (November to April) which includes dry very cold weather (December-February) known as harmattan (ENADEP, 1999).

Nkanu East and West are among the 17 constitutionally recognized Local Government Areas in Enugu State. They were part of the old Nkanu Division and both belong to the same South-East agro-ecological zone of Nigeria. Nkanu East has a population of 167,446 people, while Nkanu West has 165,106 inhabitants (by projections to 2011 from 148,774 and 146,695 people respectively on National Population Census, 2006). The people of the two LGAs are predominantly agrarian and their major crops include: yam, cassava, maize, rice, oil palm, cocoyam, cowpea, cashew, assorted vegetables, livestock and fisheries. The texture of its alluvial soil ranges from sand to clay and mainly loamy. Its surface layer is humus-rich and generally poorly drained. Estimated extension agent/farm household ratio is 1:1,500 compared to national ratio of 1:750 (Ekong, 1995).

The selection of the area was based on a reconnaissance survey and was principally due to easy accessibility. A decision was taken in consultation with ENADEP as it has a wider coverage of the area. It represents approximately 12% of Enugu State, being two out of seventeen LGAs in the state.

3.2 Sampling Procedure and Sample Size

Nkanu East and West comprise of 15 and 10 communities respectively. In this study, 60% of the communities in each LGA was purposively selected for the study. This gave 9 communities from East and 6 communities from West which totalled 15 communities. This exercise was done on the bases of: 1) proportionate representation: 2) proximity to the local government headquarters; 3) accessibility in terms of good and motorable roads; and 4) 60% was taken to achieve a wider coverage of the unit of analysis. A list of 600 farm households in the affected communities (obtained from the ENADEP Extension agents) constituted the sampling frame from which 20% was randomly drawn with replacement to produce the sample size of 120. The head of each household constituted the respondent.

3.3 Data Collection

Primary data were employed in the study using an interview schedule with each farm household as the unit of analysis. These were supported by secondary data sources from extension agents in the area, ENADEP, Institute of Agricultural Research (IAR) and NAERLS' libraries, A.B.U, Zaria, as well as International Institute for Tropical Agriculture (IITA), Technical Centre for Agricultural and Rural Cooperation (CTA) and internet.

3.4 Analytical Techniques

Descriptive statistics such as means, standard deviations, percentages, frequency distributions and rank ordering were used to achieve objectives: i, ii, iii, iv and vii. Inferential statistics such as Pearson moment correlation coefficient and regression analyses were used to achieve objectives v and vi; and test the hypotheses of the study.

Measurement of Dependent Variable (Adoption)

In this study, measurement of adoption behaviour of the farmers toward the technology packages which is the continuous use of a synthesis of 28 technologies/practices, namely:- (1) Improved maize seeds; (2) Improved cassava cuttings; (3) Ploughing; (4) Harrowing; (5) Flats; (6) Ridging; (7) Mouds; (8) Planting cassava cuttings horizontally; (9) Planting cassava cuttings vertically; (10) Planting cassava cuttings slanting; (11) Planting 2 maize seeds/hole, 2-5cm deep on one side of ridge or mound and ½ way between 2 cassava stands; (12) Spacing in maize and cassava 1m x 1m; (13) Crop population for maize: 25kg/ha; and (14) 30kg/ha; (15) Crop population for cassava: 10,000pts/ha; (16) 15,000pts/ha; and (17) 20,000pts/ha; (18) Weed control with herbicides; (19) Manual weed control; (20) Inorganic fertilizer for maize; (21) Inorganic fertilizer for cassava; (22) Organic fertilizer for both maize and cassava; (23) Harvesting maize: Green; (24) Dry; (25) Both Green and Dry; (26) Harvesting cassava 10 months after planting (MAP); (27)11 MAP and (28) 12 MAP. (N.B. Technologies/practices are as recommended by IITA, CTA and ENADEP).

The foregoing constituted the dependent or response variables of interest which were measured by using the total number of technologies/practices adopted by each respondent. The adoption score for each respondent was measured by the sum of the practices the farmers were adopting. Equal weight of a point was assigned to each technology/practice adopted by a respondent giving a maximum of twenty eight (28) points and a minimum of zero.

Measurement of Independent Variables

i. **Household size (x_1):** was based on the number of people in a household. This variable was included to prove or reject the notion that the larger the

family size the more favourably disposed will be the members to adopt improved maize and cassava technology packages.

ii. **Farm size (x_2):** was given as total area of the farm in hectares operated by the respondents and included in the model to confirm or reject the assumption that the larger the size of the farm the more feasible it is to adopt the technology packages.

iii. **Farming experience (x_3):** measured by the number of years of farming given by the respondents, which was included to prove or disprove that the more experienced farmers are the more willing to adopt an innovation.

iv. **Group affiliation (x_4):** measured by the number of organizations the respondent belonged to and was incorporated to show whether the higher the number of social groups farmers belong to, the higher the awareness of the technology packages. Rogers and Shoemaker (1971) reported that satisfactory and collective innovative decisions can be positive if there is a high degree of participation by members.

v. **Extension contact (x_5):** showed the number of visits/year made by the extension agent to the farmer and vice versa. This was equally included to establish or reject the impression that frequency of visits to the farmers by the extension agent or vice versa would influence farmers' awareness of the innovations. Score: 'Yes' 1 'No' O. No of visits were measured as follows:- Once : 1pt; 2 times : 2pts; 3 times : 3pts; 4times: 4pts.

vi. **Mass media exposure (x_6)** two-way questions (i.e. 'Yes' or 'No') were asked to elicit information on the extent of the respondents' utilization of mass media sources of information on improved maize and cassava

technology packages in the area (e.g. radio, television and agricultural publications). This variable was incorporated into the study to affirm or debunk Voh's (1984) hypothesis that mass media channels of communication are important in conveying information and creating awareness or changing cognition. A positive response 'Yes' was scored one (1) point while a negative response 'No' was scored zero (0).

Innovation Attributes

vii. Relative Advantage: The variable was included so as to establish whether or not respondents would assert the superiority of the technology packages over existing practices. 'Yes' was scored one (1) point and 'No' was scored zero (O).

viii. Compatibility: Is the degree to which an innovation is consistent with existing values or past experiences of the people. 'Yes' response earns one (1) point while 'No' earns nothing or zero (0).

ix. Complexity: Is the extent to which the innovation is not complex (i.e. not complicated). 'Yes' response earns one (1) point while 'No' gets zero (0).

x. Trialability: Is the degree to which an innovation can be tested on a limited scale. 'Yes' gets one (1) point while 'No' receives zero.

xi. Observability: Is the extent to which results of adoption are clearly visible. 'Yes' response scores one (1) point while 'No' receives zero point.

xii. Availability: Establishes whether all the components of the innovation packages are accessible within the area or not. 'Yes" response earns one (1) point while 'No' receives nothing or zero (0).

3.4.1 Regression Model

The form of the regression model used is specified as:

$$Y = a + b_1x_1+b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + b_{10}x_{10} + b_{11}x_{11} + b_{12} + \iota \quad \text{.....(i)}$$

Where:

Y = Number of recommended practices adopted by the respondent

a = Constant

b_1-b_{12} = Regression coefficients

x_1 = Household size (number of dependants including household head)

x_2 = Size of farm operated (hectares)

x_3 = Farming experience (number of years)

x_4 = Group affiliation (number of social groups)

x_5 = Extension contact (number of visits/year)

x_6 = Mass media exposure (number of channels the farmer is exposed to)

x_7 = Relative advantage over the status quo (in terms of superiority; number).

x_8 = Compatibility (conformity with society's cultural practices; number)

x_9 = Complexity (ease of understanding and usage; number)

x_{10} = Trialability (testability; number)

x_{11} = Observability (clarity of difference(s) from the results; number).

x_{12} = Availability (ease of obtaining the technology or technologies; number)

ι = Error term

N.B. X_7-X_{12} : Response) Yes =1; No = 0 and No opinion = O

3.4.2 Hypotheses' Testing

Z statistic was employed in testing hypothesis 3 of the study:

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{S_1}{n_1} + \frac{S_2}{n_2}}} \qquad \ldots\ldots\ldots\ldots (ii)$$

Where:

Z = Calculated Z value

$\overline{X}_1$ = Mean value of {production in tonnes after adoption income in Naira after adoption well-being in score value after adoption}

$\overline{X}_2$ = Mean value of {production in tonnes before adoption income in Naira before adoption well-being in score value before adoption}

S_1 = Standard deviation of {production in tonnes after adoption income in Naira after adoption well-being in score value after adoption}

S_2 = Standard deviation of {production in tonnes before adoption income in Naira before adoption well-being in score value before adoption}

n_1 = Sample size of respondents after adoption

n_2 = Sample size of respondents before adoption

The calculated absolute value was compared with critical value, and if the calculated value was greater than the critical (table) value, the null hypothesis was rejected, if otherwise, the null hypothesis was accepted.

3.5 Concept of Effect

Rogers (1982) conceived effect as changes that occur in a social system as a result of adoption or rejection of an innovation. The magnitude and types of effects of a technology depend on the innovation itself, the time since initial adoption, socio-economic setting and the objective of developing the technology (Ohunene, 2009). The concept provided useful insights for interpreting the effects of using improved maize and cassava technology packages by farmers in the study area in terms of production, income and perceived individual well-being. The scale values were measured as follows:-

Very happy : 4 points

Happy : 3 points

Unhappy : 2 points

Very unhappy : 1 point.

CHAPTER 4

4.0 RESULTS AND DISCUSSION

This chapter contains the presentation and discussion of the research findings based on the specified study objectives.

4.1 Main sources of information to the farmer: As shown in Table 4.1 the main sources of information used by the farmers were: radio with 84.40% which ranked first, television with 73.69% ranked second, friends and relatives with 72.98% ranked third, extension service with 69.29% was fourth, while GSM phone with 25.11% was last.

Table 4.1: Distribution on main sources of information on improved maize and cassava technology packages

Sources of Information	Improved maize/cassava cultivars	Seed-bed preparation	Planting method and spacing	Crop population	Weed control	Fertilizer application	Harv	%	Rk
	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq		
Radio	116	99	111	58	105	109	111	84.40	1st
TV	99	86	83	83	82	93	93	73.69	2nd
Friends and relatives	108	89	83	81	84	86	82	72.98	3rd
Agric. ext. agent	90	77	83	81	84	82	85	69.29	4th
Agric orgs.	87	75	69	78	79	87	85	66.55	5th
Market-place	96	86	67	76	57	71	69	65.71	6th
Agric. publ.	41	39	68	45	79	87	85	52.86	7th
GSM phone	42	31	35	10	37	27	29	25.11	8th

In the aftermath of preliminary visits to the area before this study, the imperative to expose the farmers to a variety of information sources from which they could choose their preferences became apparent. Hence, both conventional and traditional information sources were used in the study. The first ranking position of radio was in agreement with findings from most previous studies which

ENADEP fully exploited by using the radio as a powerful medium to create awareness about the recommended practices since 2004 in the study area. This impacted quite positively as rate of awareness promptly took off at 10% in the same year and rose to 28% in 2009. Yazidu (1973) and Voh (1979) in their separate studies emphasized the key role that radio plays in getting information across to farmers. Matanmi (1989) awarded 71% to radio as the most used source of information to farmers, while the Food and Agriculture Organization (FAO) in campaigns to increase rice production in Sierra Leone in 1991 discovered that by using radio broadcasts supplemented with village-based slide tape presentations increased knowledge levels by almost 60% over baseline scores. Coldevin (1991) reported that regular listeners gain information twice more than the sporadic listeners while Benor (1984) stated that radio and television can reinforce the work of extension agents by giving publicity about the (T&V) system and by providing farmers with relevant technical advice.

The second choice source of information in the area being television is shown to have received a boost in ownership by farmers in the area (Fig. 6b). Therefore, with a combination of both sources augmented by extension activities and social organizations, greater impact in winning adopters of agricultural innovations in the area will be more assured.

4.2 Factors and Innovation Attributes Affecting Adoption of the Recommended Practices

Results of factors and innovation attributes affecting adoption are presented as follows:-

Household Size: Household size composed of 6-10 persons/household constituted 63.33% while those comprising 11-15 members took up 33.33% and the least

household size of 1-5 persons accounted for 3.33% (Table 4.2). The mean household size was 9 which represented a moderate-sized household in the study area. This implies that farm households have cheap source of labour at their disposal and hence may not have to hire extra labour as they adopt the technology packages. More so as manual weeding is the preferred method of weed control in the area vis-á-vis agro-chemicals (Table 4.5), farm households can boast of sufficient manpower to carry out weeding operations on their farms. This may have accounted for the regression co-efficient result for household size being insignificant in the area at the time of the study.

This finding agrees with Njoku (1991) and Voh (1979) who found that smaller households are more innovative than larger households, while Atala (1980) reported a neglible positive relationship between household size and adoption. Igbokwe (1984) and Obeta and Nwagbo (1990) also announced a positive relationship between household size and adoption of innovations.

Farm size: Respondents that owned land of 1-3 hectares/farm household constituted 51.67%. while 25.00% owned land of 4-6ha/farm household, while 8.34% owned from 10 hectares and above. The mean of landholding was 4.13ha. The implication of this result is that land is available for the adoption of the technology packages. Compared with the finding of Onazi (1978) who reported that average landholding in Nigeria as 2 hectares, the area has sufficient land suitable for commercial agriculture.

But contrary to a priori expectation which was that the more land was available the higher the probability of adopting the technology packages by the farmers, multiple regression result revealed it is not significant to adoption (Table 4.7).

This may not be unconnected with menace of red monkies in the area that prevents the farmers from reaping maize cobs – green or dry or both. This among other constraints (e.g. lack of tractors for hiring and shortage of inputs) being encountered by the farmers (Table 4.9) is capable of discouraging adoption of the technology packages, thereby paving way for discontinuance.

Iyere (1985), Onu (1991), Agbamu (1993) and Okwoche *et al*. (1998) found a positive correlation between farm size and adoption whereas Adekoya and Ajayi (2000) and Ladebo (1999) found a negative correlation between farm size and adoption of innovations.

Farming experience: Respondents who have had 8-4 years farming experience took up 51.67% followed by 15-21 years experience representing 25.83% while 22 years and above constituted 11.66%. Result equally showed that 10.83% of the respondents had less than 8 years of farming experience. The mean of farming experience was 14 years. This finding implies that the farmers in the area were highly experienced. The variable was found to be highly significant on correlation and regression coefficient results at $p<.01$.

The result equally conforms with findings of Ozor (1998) and Bello (2000) who in their separate studies established positive association between farming experience and adoption.

Group affiliation: Respondents showed that 44.20% of the respondents belonged to 3-4 social groups, 35.00% belonged to 1-2 groups, while 20.80% belonged to 5 and above social groups. Result equally showed that every member of the sample belonged to at least one group (Table 4.2). The mean of group membership was 3.

The finding is in agreement with Asifat (1986), Ngwu (1989) and Onu (1991) who reported a positive association between group participation and adoption of innovations. Membership of agricultural groups and associations is accepted as a means of information dissemination and exchange of ideas as well as sharing experience among farm households. A study by Pradhan (1989) revealed that farmers' organizations can assist farmers in forwarding their opinions and requests to the government, NGOs and donor agencies when their attention are needed. The finding showed that group affiliation significantly and positively correlated with adoption of improved maize and technology packages by farmers at $p<.05$. Indeed the farmers' positive attitude to participate in activities of social organizations is a big plus for adoption and continued adoption of improved maize and cassava technology packages in the area, especially when they are quite aware of the advantages.

Extension contact: Extension contact was measured by frequency of the farmers' meetings with extent agents. Results showed that 52.50% had 3 times visits in the preceding year while 12.50% had 2 times and 27.50% had 4 times visits. One visit received 7.50% (Table 4.2). The mean of visits was 3 times/p.a.

One visit/quarter is below expectation. The interviewers who are ENADEP extension agents complained of acute shortage of extension staff. If more personnel were engaged they recommended at least one visit every other month or 6 visits per annum. The more frequent the extension contacts with farmers are, the more information and innovations would be disseminated.

The variable was found to be positively and strongly correlated with adoption of improved maize and cassava technology packages at $p<.05$. This position received

earlier support of Amotsuka and Onu (1991) when they equally reported a close and positive association between extension contact and adoption.

Mass media exposure: The result revealed as shown in Table 4.2 that respondents who listen to agricultural programmes constituted 94.17% while 5.83% do not; also while 54.17% watch agricultural programmes on television 45.83% do not; and 53.33% read agricultural publications while 46.67% do not read. Furthermore, the total numbers of radio and television sets owned by respondents in the area in 2010 were 222 and 114 respectively (Fig. 6b). Thus, the finding revealed that awareness levels of the farmers about the technology packages were quite high.

Innovation Attributes

The following innovation attributes of improved maize and cassava technology packages were considered in the study. They comprised: relative advantage, compatibility, complexity, trialability, observability and availability of the components in the area (Table 4.3).

Relative Advantage: Result from relative advantage showed that 62.50% of the respondents were affirmative while 37.50% were negative. This implies that most of the respondents initially perceived the superiority of the improved maize and cassava technology packages that ENADEP introduced. Correlation analysis equally showed that the attribute correlated with adoption at $p<.05$. However, regression result revealed it was not significant, hence it could not influence adoption (Table 4.7).

Relative advantage is defined as the degree to which an innovation is superior to the idea it supersedes. In this case, ENADEP having earlier created awareness

about the technology packages via radio spot announcements, the seriousness with which members of the social system welcomed the technology packages was a clear indication of the relative advantage the new technologies had among the farmers. However their hopes and expectations were eroded when some of the key components (viz hybrid maize seeds and improved cassava stems, as well as inorganic fertilizers) were in short supply. This led to many of the farmers resorting to local practices which negatively affected adoption rate (Fig. 5). Thus, the factor could not contribute to adoption a priori.

Compatibility: Result in Table 4.3 showed that 72.50% responded positively while 27.50% responded negatively. Correlation analysis (Table 4.6) and regression analysis (Table 4.7) showed compatibility attribute as being significantly associated with adoption of the technology packages at $p<.05$.

Compatibility is the degree to which an innovation is consistent with existing values and past practices of the adopters. However, some of the respondents declared that horizontal and vertically methods of planting cassava cuttings as well as planting cassava 15,000 and 20,000 pts/ha and harvesting cassava 10 MAP and 11MAP as being incompatible. The overall implication is that by the above result the prospect of sustainability of adoption of the two packages is enhanced. The more total components are made available in the area, the more adopter curve will climb.

Complexity: The findings (Table 4.3) were 81.67% affirmative and 18.33% non-affirmative which according to correlation analysis was significantly correlated with adoption at $p<.01$**.** Regression result also supports its significance at $p<.01$

*(*Tables 4.6 and 4.7). The findings imply that farmers had no difficulty understanding and handling all the components, of the technology packages.

Non-complexity is the degree to which an innovation is not difficult to use. By eliciting a direct Yes or No answer, it made feedback from respondents a lot easier. Based on responses of the respondents as well as correlation and regression results, the technology packages were declared not complex, hence the attribute contributed significantly in increasing the rate of adoption in the area at the time of the study.

Trialability: Results showed that 65% of the respondents gave a positive answer while 35% gave a negative answer. The attribute though statistically significant with adoption at $p<.05$ as per correlation result, it was not confirmed by regression analysis which held that it was not significant (Table 4.3).

Trialability, as the degree to which an innovation is testable on limited basis before adoption, was shown from findings in this study not to have contributed to adoption. The insufficiency of inputs stated earlier may have had a part to play as some components were not available for most of the farmers to try out on plots on their own land before reaching a decision for or against.

Observability: The findings were: 70% agreed while 30% disagreed. Correlation analysis shows it was significantly associated with adoption at $p<.05$**.** But with regression result it was found to be not significant at $p<.05$ and was inversely related to adoption.

Observability attribute is the degree to which the results of an innovation are readily seen. However it became the reverse in the area as a paucity of inputs hampered demonstration experiments. Hence adoption rate was hampered in the

sense that the more the attribute was emphasized or increased the less adoption occurred.

Availability: Results showed that 70% of the respondents chose 'Yes' while 30% mentioned 'No' which shows it was positively correlated with adoption.

Availability is the degree to which complete components of the two packages are accessible to farmers in the study area. Correlation result showed that the attribute was statistically linked to adoption albeit inversely at $p<.05$ while by regression analysis it was not significant at $p<.05$ (Table 4.7). The negative value was due to non- availability of key components of the packages in the area at the time of the study. It is noteworthy that the low performance of this variable to a large extent was inimical to most of the other attributes.

Table 4.2: Distribution of respondents according to factors affecting farmers' adoption of improved maize and cassava technology packages n = 120

Factors		Frequency	Percentage
Household size (No.)	1-5	4	3.33
	6-10	76	63.33
	11-15	40	33.33
	Mean=9.5		
Farm size (ha)	<1		
	1-3	1	0.83
	4-6	62	51.67
	7-9	30	25.00
	10-12	17	14.17
	>12	5	4.17
	Mean = 4.13ha	5	4.17
Farming experience (Years)	1-7	13	10.83
	8-14	62	51.67
	15-21	31	25.83
	22-28	6	5.00
	29-35	7	5.83
	>35	1	0.83
	Mean = 14 yrs		
Group affiliation (No.)	1-2	42	35.00
	3-4	53	44.20
	5-6	13	10.80
	>6	12	10.00
	Mean = 3		
Extension contact (No.)	Once	9	7.50
	2 times	15	12.50
	3 times	63	52.50
	4 times	33	27.50
	Mean = 3times/p.a.		
Mass media exposure			
Radio: Listen to agricultural programmes	Yes	113	94.17
	No	7	5.83
Television: Watch agric. prog.	Yes	65	54.17
	No	55	45.83
Read agricultural publications	Yes	22	53.33
	No	98	46.67
	Total		**100.00**

Table 4.3: Distribution of respondents according to innovation attributes n = 120

Innovation attributes	Frequency		Percentage
Relative advantage:			
Innovation is superior to exiting practices.	Yes	75	62.50
	No	45	37.50
Compatibility:			
Innovation is culturally compliant.	Yes	87	72.50
	No	33	27.50
Complexity:			
Innovation is not difficult to use/handle.	Yes	98	81.67
	No	22	18.33
Trialability:			
Innovation is testable.	Yes	78	65.00
	No	42	35.00
Observability:			
Innovation result is observabable.	Yes	84	70.00
	No	30	30.00
Availability:			
Innovation is readily Available.	Yes	72	60.00
	No	48	40.00
	Total		**100**

4.3 Rates and levels of awareness

4.3.1 Rate of Awareness

Rate of awareness is the relative speed with which members of a social system become aware of innovations over time and space. It is determined as a proportion of members who have heard of improved practices over the sample members as a percentage.

$$\frac{\text{No. aware}}{\text{No. in the sample}} \times \frac{100}{1}$$

In the present study, the respondents were asked whether at that time (in 2009) they were aware or not of the innovations and when they first heard of the innovations. Calculation of awareness rate for each relevant year was based on the above parameters. Fig. 4 shows that the awareness rate in 2004-2005 cropping season was 10% and in the following year, it rose to 13%. At the time of the study in 2008-2009 the rate was 28%. Thus, a normal curve was in the offing.

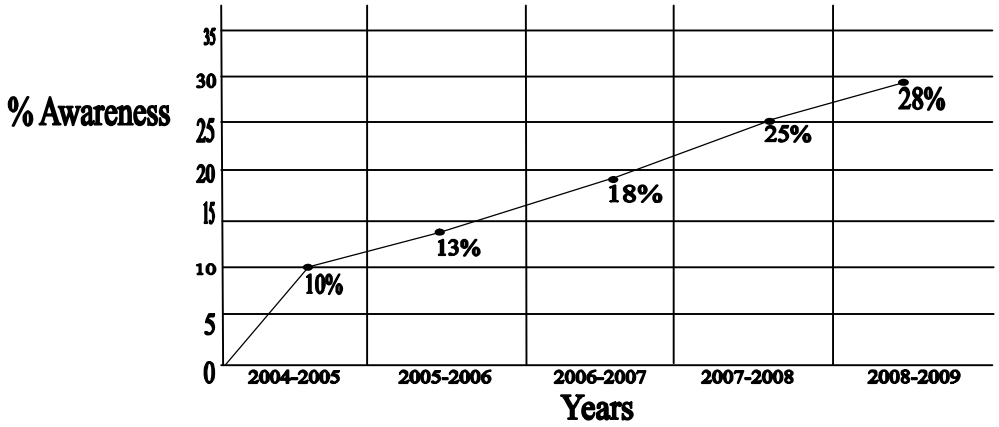


Figure 4: Rate of awareness of recommended technology packages

4.3.2 Level of Awareness

The percentages of respondents that were aware of the practices are shown in Table 4.4. The analysis showed as follows:- that 95% of the respondents opted for manual weeding, followed by planting of improved maize seeds and cassava cuttings, slanting method of planting cassava cuttings and mounds, were chosen by 93.33%.

This implies that farmers in the area are totally ignorant of advantages in use of herbicides. However, their acceptance of improved cultivars and unawareness of non-compliant vertical and horizontal methods of planting cassava were noted.

Table 4.4: Distribution of respondents according to levels of awareness and unawareness of recommended practices n = 120

Technologies/Practices	Level of Awareness			
	Aware		Not aware	
	Frequency	Percentage	Frequency	Percentage
A. Improved maize and cassava cultivars	112	93.33	8	6.67
B. Seed –bed preparation				
1. Ploughing	79	65.83	41	34.17
2. Harrowing	80	66.67	40	33.33
3. Flats	74	61.67	46	38.33
4. Ridging *	104	86.67	16	13.33
5. Mounds *	112	93.33	8	6.67
C. Planting method and spacing				
1a. Planting cassava cuttings horizontally*	4	3.33	116	96.67
1b. Planting cassava cuttings vertically*	4	3.33	116	96.67
1c. Planting cassava cuttings slanting *	112	93.33	8	6.67
2. Planting 2 maize seeds 2-5cm deep ½ way between 2 cassava stands on one side of ridge or mound	99	82.50	21	17.50
3. Spacing for maize and cassava: 1m x 1m apart	103	85.83	17	14.17
D. Crop population				
1a. Maize 25kg/ha **	95	79.17	25	20.83
1b. Maize 30 kg/ha	16	13.33	104	86.67
2a. Cassava: 10,000pts/ha *	97	80.83	23	19.17
2b. Cassava: 15,000pts/ha *	13	10.83	107	89.17
2c. Cassava: 20,000pts/ha	9	7.50	111	92.50
E. Weed control				
1. Herbicides *	58	48.33	62	51.67
2. Manual *	114	95.00	6	5.00
F. Fertilizer application				
1. Inorganic for maize *	99	82.50	21	17.50
2. Inorganic for cassava *	99	82.50	21	17.50
3. Organic for maize and cassava	109	90.83	11	9.17
G. Harvesting time				
1a. Maize (Green) **	64	53.33	56	46.67
1b. (Dry)	22	18.33	98	81.67
1c. Both (green and dry)	34	28.33	86	71.67
2a. Cassava 10 MAP	21	17.50	99	82.50
2b. Cassava 11 MAP *	15	12.50	105	87.50
c. Cassava 12 MAP *	78	65.00	42	35.00

Key: * Recommended by IITA *Source:* IITA 1990: 53-65.
** Recommended by CTA *Source: CTA 1987:44-47.*

4.4 Rates and levels of adoption

4.4.1 ***Rate of Adoption*:** Rate of adoption is the relative speed with which an innovation is adopted over time and space by members of a social system measured by:

$$\frac{\text{No. of adopters}}{\text{No. in the sample}} \times \frac{100}{1}$$

At the time of the study (in 2009), respondents were asked whether they had adopted or not adopted the technology packages and when they first adopted the technology packages. The innovations which were introduced in 2004-2005 cropping season received minimal attention as per adoption in that year (Fig. 5). But by 2005-2006 cropping season, adoption picked up gradually at 7%, rising briskly to 17% the following year, and to 23% in 2007-2008, only to drop to 20% in 2008-2009 due to non-availability of inputs such as improved maize seeds and cassava cuttings, as well as inorganic fertilizers. This development compelled the farmers to resort to local practices for that year.

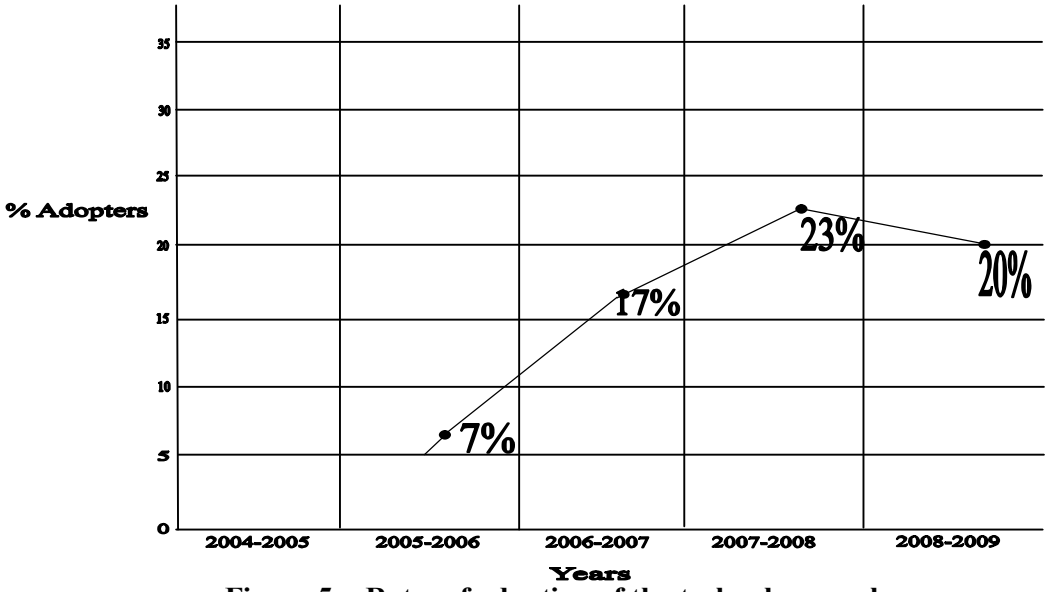


Figure 5: Rates of adoption of the technology packages

4.4.2 Levels of Adoption

Data in Table 4.5 revealed that 95% and 84.17% of the respondents respectively adopted manual weeding and improved maize and cassava cultivars while 91.67% adopted organic manure for their crops. As for non-adopter category 95.83% and 92.50% respectively rejected horizontal and vertical methods of planting cassava cuttings, whereas 5% rejected manual weeding. 82.50% opted for the new cassava

and maize planting technology. This retrogressive practice of manual weeding by farmers in the study area is discouraging.

Table 4.5: Distribution of respondents according to levels of adoption and non-adoption of recommended practices
n = 120

Technologies/Practices	Level of Adoption			
	Adopter		Non-Adopter	
	Frequency	Percentage	Frequency	Percentage
A. Improved maize and cassava cultivars	101	84.17	19	15.83
B. Seed–bed preparation				
1. Ploughing	42	35.00	78	65.00
2. Harrowing	35	29.17	85	70.83
3. Flats	33	27.50	87	72.50
4. Ridging *	57	47.50	63	52.50
5. Mounds*	87	72.50	33	27.50
C. Planting method and spacing				
1a. Planting cassava cuttings horizontally*	5	4.17	115	95.83
1b. Planting cassava cuttings vertically*	9	7.50	111	92.50
1c. Planting cassava cuttings slanting *	106	88.30	14	11.67
2. Planting 2maize seeds 2-5cm deep ½ way between 2 cassava plants on one side of ridge or mound	99	82.50	21	17.50
3. Spacing for maize and cassava: 1m x1m apart	99	82.50	21	17.50
D. Crop population				
1a. Maize 25kg/ha**	100	83.33	20	16.67
1b. Maize 30 kg/ha	19	15.83	101	84.17
2a. Cassava: 10,000pts/ha*	58	48.33	62	51.67
2b. Cassava: 15,000pts/ha*	37	30.83	83	69.17
2c. Cassava: 20,000pts/ha	22	18.33	98	81.67
E. Weed control				
1. Herbicide *	58	48.83	62	51.67
2. Manual *	114	95.00	6	5.00
F. Fertilizer Application				
1. Inorganic for maize *	92	76.67	28	23.33
2. Inorganic for cassava *	98	81.67	22	18.33
3. Organic for maize and cassava	110	91.67	10	8.33
G. Harvesting time				
1a. Maize (Green) **	83	69.17	37	30.83
1b. (Dry)	23	19.17	97	80.83
1c. Both (green and dry)	11	9.17	109	90.83
2a. Cassava 10 MAP	21	17.50	99	82.50
2b. Cassava 11 MAP *	11	9.17	109	90.83
2c. Cassava 12 MAP *	79	65.83	41	34.17

Key: * Recommended by IITA *Source:* IITA 1990: 53:65.
** Recommended by CTA *Source: CTA 1987:44-47.*

4.5 Relationships between factors affecting adoption, in relation to innovation attributes, and farmers' adoption behaviour

Results of Pearson product moment correlation analysis in Table 4.6 and correlation matrix in Appendix II revealed that eight (8) variables were significantly related to adoption of improved maize and cassava technology packages at 5% level of probability. These variables were: household size r = .426, Farm size r = .210, Group membership r = .523, Mass media exposure r = .411, Relative advantage r = - .209, Compatibility r = .541, Trialability r = .225 and Observability r = .318. Four (4) variables were equally significantly correlated with adoption at 1% level of probability. These variables were: Farming experience r = .621, Extension contact r = .742, Complexity r = .603 and Availability r = -.284. The inverse relationships of Relative advantage and Availability with adoption was due to non-availability of inputs such as inorganic fertilizers, maize seeds and sufficient cassava stems in the study area at the time of the study.

Table 4.6: Correlation coefficient results of factors and innovation attributes affecting adoption of improved maize and cassava technology packages by farmers

Independent Variables	Coefficient of Correlation
Household size	.426**
Farm size	.210**
Farming experience	.621*
Group membership	.523**
Extension contact	.742*
Mass media exposure	.411**
Relative advantage	- 209**
Compatibility	.541**
Complexity	.603*
Trialability	.225**
Observability	.318**
Availability	-.284*

**Correlation is significant at 5% level (2tailed)
*Correlation is significant at 1% level (2-tailed)

The regression analysis was used to determine the factors in relation to attributes affecting adoption. The coefficient of multiple determination (R), which is the contribution of all the independent variables to the adoption of the recommended practices was 68%. This implied that the effects of all these variables accounted for 68% variation in the level of adoption. Table 4.7 shows that Group membership .028, Mass media exposure .081 and Compatibility .155 were significant at 5% level of probability, while Farming experience .020, Extension contact .025 and Complexity .077 were significant at 1% level of probability. The other variables made no significant contributions to adoption of improved maize and cassava technology packages, meaning that a farmer could still adopt the technologies regardless of those factors and attributes.

Table 4.7: Estimated multiple regression co-efficient of factors and innovation attributes affecting farmers' adoption of improved maize and cassava technology packages

Independent variables	Regression coefficients	Standard error	t-values
Household size	0.0167	0.020	1.532 ns
Farm size	0.173	0.054	0.932 ns
Farming experience	0.020	0.040	4.041* s
Group membership	0.028	0.010	2.89** s
Extension contact	0.025	0.079	6.221* s
Mass media exposure	0.081	0.132	1.992** s
Relative advantage	0.161	0.210	0.841ns
Compatibility	0.155	0.012	2.698** s
Complexity	0.077	0.015	3.981* s
Trialability	0.093	0.101	0.649 ns
Observability	0.033	0.029	-1.298 ns
Availability	0.161	0.034	-1.006 ns

$R^2 = 0.6809$
$\overline{R}^2 = 0.6643$
F-ratio = 35.932
Degree of freedom (DF) = 118
** = significant at 5% level of probability (2 – tailed)
* = significant at 1% level of probability (2 – tailed)
s = Significant
ns = Not significant

4.6 Effects of adoption on farmers' production, income and perceived individual well-being: The effects of adoption of improved maize and cassava technology packages by famers in the study area were clearly demonstrated as follows:-

a. ***Production*****:** Before adoption, 12.50% of the respondents were producing 8-10 tonnes/ha but after adoption 41.67% of the respondents were found in that class, which amounted to 29.17% increase in production level. Also the mean production level increased from 4.57-5.16tonnes/ha (Table 4.8a).

Table 4.8a: Distribution of respondents according to their production levels before and after adoption
n = 120

Production Levels					
Before			After		
Tonnes/ha	No. of Respondents	%	Tonnes/ha	No. of Respondents	%
< 2	28	23.33	< 2	9	7.50
2-4	52	43.33	2-4	11	9.17
5-7	13	10.84	5-7	13	27.50
8-10	15	12.50	8-10	50	41.67
11-13	12	10.00	11-13	10	8.33
≥14	-	00.00	≥14	7	5.83
Mean = 4.57			Mean = 5.16		

i. ***Income:*** Before adoption 17.50% of the respondents earned income of ₦15,001-₦20,000.00/ha but after adoption 48.33% of the respondents earned income of ₦15,001 – ₦20,000/ha representing 30.83% increase in income level. Also their mean income level increased from N13,875.41 – N16, 412.92/ha (Table 4.8b).

Table 4.8b: Distribution of respondents according to their income levels before and after adoption n= 120

Income Levels					
Before			**After**		
₦/ha	**No. of Respondents**	%	**₦/ha**	**No. of Respondents**	%
< ₦ 10,000	22	18.33	< ₦ 10,000	6	5.00
₦ 10,001 - ₦ 15,000	58	48.33	₦ 10,001 - ₦ 15,000	13	10.83
₦ 15,001 - ₦ 20,000	21	17.50	₦ 15,001 - ₦ 20,000	45	48.33
₦ 20,001 - ₦ 25,000	12	10.00	₦ 20,001 - ₦ 25,000	23	19.17
₦ 25,001 - ₦ 30,000	7	5.84	₦ 25,001 - ₦ 30,000	17	14.17
≥ ₦ 30,001	-		≥ ₦ 30,001	3	2.30
Mean = N13, 875.41			Mean – N16,412.92		

ii. ***Perceived individual well-being:*** On the farmers' perceived individual well-being, 52.50% of the farmers responded "Very happy" after adoption over 19.17% before; representing an increase of 33.33%. This indicated a positive effect on the farmers' well-being after adopting the technology packages (Table 4.8c). Also their mean level of contentment increased from score 2.43-3.20.

Table 4.8c: Distribution of respondents according to their perceived individual well-being before and after adoption n = 120

Individual Well-being					
Before			**After**		
Disposition	**No. of Respondents**	%	**Disposition**	**No. of Respondents**	%
Very happy	23	19.17	Very happy	63	52.50
Happy	27	22.50	Happy	30	25.00
Unhappy	48	40.00	Unhappy	15	12.50
Very unhappy	22	18.33	Very unhappy	12	10.00
Mean = 2.43			Mean = 3.20		

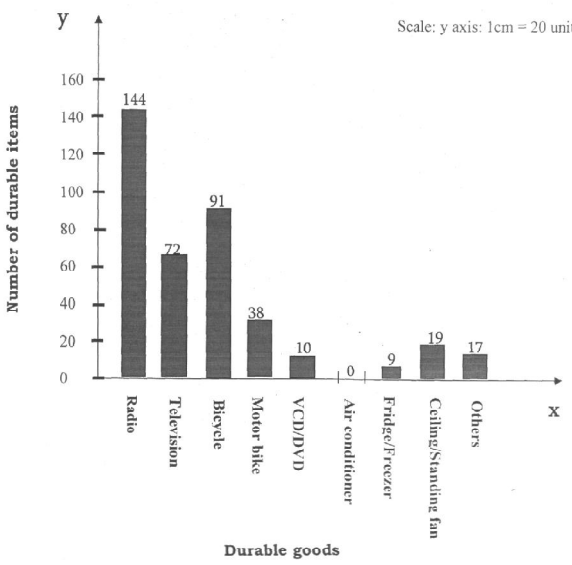


Figure 6a: Bar chart of durable goods owned by the respondents before adoption (2008).

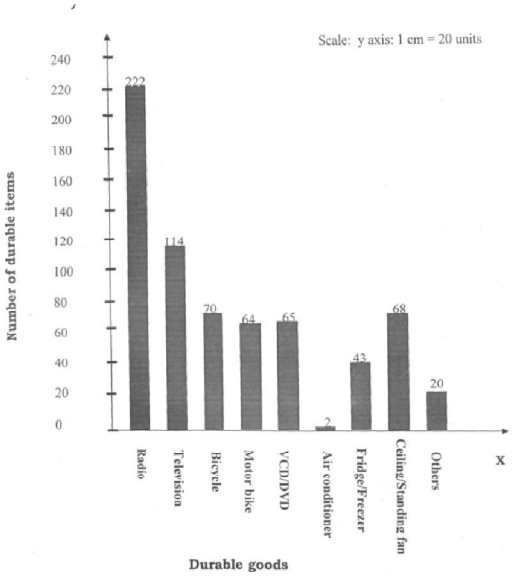


Figure 6b: Bar chart of durable goods owned by the respondents after adoption (2010).

Ownership of durable goods

As shown in Figure 6a and 6b, the ownership of durable goods by the farmers improved significantly in 2010 after adopting improved maize and cassava technology packages via á vis 2008 as further evidence of improved living standard and perceived individual well-being. For instance before adoption, the respondents owned 144 radio sets, 72 television sets, 91 bicycles and 38 motor bikes among others; whereas after adoption they owned 222 radio sets, 114 TVs, 70 bicycles and 64 motor bikes among others. Before adoption, none of the farmers owned air conditioners but after adoption some of them acquired 2 units of air conditioners. Also, due to improved standard of living, ownership of bicycles dropped from 91 (before) to 70 (after adoption) with concurrent increase in number of motor bikes which rose to 64 after adoption from previous figure of 38 before adoption.

4.7 Constraints to farmers' adoption:

Results as presented in Table 4.9 show that non-availability of inputs, especially inorganic fertilizers ranked first, with 91.67% of the respondents mentioning the constraint. This impacted negatively on the level of adoption of recommended practices in the study year. It was closely followed by lack of access to tractors for hiring with 75% of the farmers assenting to the constraint. Other problems faced by the respondents are the children's reluctance to assist them on the farms which was pin-pointed by 70.83% and lack of credit linkage attested to by 60% of the respondents. Lack of market for fresh roots of cassava and non-contact with extension agents mentioned by 33.33% and 26.67% of the farmers respectively constituted other challenges being encountered. Pest infestation, dearth of good and motorable roads, distance from cassava processing facilities and inability to handle agro-chemicals constituted other problems raised by respondents which ranged from 25.83% - 12.50%.

Aggregated, the foregoing problems facing the farmers are capable of adversely affecting adoption rates of improved maize and technology packages in the area if urgent steps are not taken to arrest them. For instance, if the farmers are not urgently introduced to uses and abuses of agro-chemicals as well as subsidising their costs, the level of their adherence to manual weeding which currently stands at 95% (Table 4.5) will not abate which portends a bleak future for modernization and transformation of agriculture in the area.

Table 4.9: Distribution of respondents according to constraints to adoption of improved maize and cassava technology and packages by farmers n= 120

Constraints	Level of difficulty		
	Frequency	Percentage	Rank
1. Non-availability of fertilizers	110	91.67	1st
2. Non-availability of tractors for hiring	90	75.00	2nd
3. Non-assistance of children with farm work	85	70.83	3rd
4. Shortage of improved cassava cuttings and hybrid maize seeds	75	62.50	4th
5. Insufficiency of land for production	75	62.50	4th
6. Non-availability of credit to buy inputs	72	60.00	6th
7. No market for fresh cassava roots	40	33.33	7th
8. Lack of contact with extension staff	32	26.67	8th
9. Others (e.g. prevalence of red monkies being pests to maize, bad roads, inability to handle herbicides etc.)	31	26	9th
10. No cassava processing facility nearby.	15	12.50	10th

4.8 Hypotheses' Testing

Hypothesis 1

It was hypothesized that there is no significant relationship between factors affecting adoption of improved maize and cassava technology packages and farmers' adoption behaviour. Coefficient of correlation result contained in Table 4.6 and correlation matrix in Appendix II showed that at significant level of $p<.05$, Farm size (x_2) with correlation value of .210 had a positive but weak correlation with adoption of improved maize and cassava technology packages and Household size (x_1) and Mass media exposure (x_6) with correlation value of .426 and .411 respectively had positive but moderate correlation values with

adoption; Farming experience (x_3), Group membership (x_4) and Extension contact (x_5) with correlation values of .621, .523 and .742 respectively had positive and strong relationships with adoption of improved maize and cassava technology packages.

The regression results showed that Household size (x_1) and Farm size (x_2) were not significant at $p<.05$. Thus both variables did not contribute to adoption of improved maize and cassava technology packages in the study area; whereas Farming experience, (x_3) and Extension contact (x_5) were significant at $p<.01$ while Group membership (x4) and Mass media exposure (x_6) were significant at $p<.05$. Hence, the four variables made significant contributions to adoption of the technology packages. Therefore null hypothesis of no difference is rejected and the alternative accepted. Besides, any test of hypothesis that yields significant results must have been one for which null hypothesis must have been rejected (Imoisili, 1996).

Hypothesis 2

It was also hypothesized that there is no significant relationship between innovation attributes and farmers' adoption behaviour. The correlation results revealed that Relative advantage (x_7), Trialability (x_{10}) and Observability (x_{11}) had positive but weak correlations with adoption behaviour of farmers with correlations values of -.209, .225 and .318 respectively; while Availability (x_{12}) had -.284 (inverse); Compatibility (x_8) and Complexity (x_9) had positive and strong correlations at $p<.05$ and $p<.01$ with farmers' adoption behaviour with correlation values of .541 and .603 respectively.

The regression results showed that Relative advantage (x_7), Trialability (x_{10}), Observability (x_{11}) and Availability (x_{12}) were not significant at $p<.05$. The implication is that these variables had no influence on adoption behaviour of the farmers whereas compatibility and complexity had influence on adoption at $p<.05$ and $p<.01$ respectively. With the above results and analyses, the null hypothesis is not tenable while the alternative is accepted.

Hypothesis 3

It was hypothesized that there is no significant relationship between farmers' adoption behaviour and production, income and perceived individual well-being.

i. ***Production***

The Z-test in Table 4.10a shows a significant increase in the mean score value of 278.94 before adoption to 386.08 after adoption. By this result the null hypothesis is rejected and the alternative accepted.

Table 4.10a: Z-test result showing farmers' production levels before and after adoption

Variable	N	Mean	SD	Z-Calculated	Z-Critical	Level of probability
Before	120	278.94	96.82			
After	120	386.08	164.23	4.86	1.64	5%

b. Income

The Z-test in Table 4.10b shows respondents' income levels before and after adoption. With a mean increase from score value 312.89 before adoption to 769.10 after adoption, the null hypothesis is rejected and the alternative accepted.

Table 4.10b: Z–test result of farmers' income level before and after adoption

Variable	N	Mean	SD	Z-Calculated	Z- Critical	Level of Probability
Before	120	312.89	108.33			
After	120	769.10	456.10	18.69	1.64	5%

c. Perceived individual well-being

From Z-test result in Table 4.10c, with a mean score level of perceived individual well–being of the farmers increasing from 223.48 before adoption to 562.90 after adoption, null hypothesis is also rejected and alternative accepted.

Table 4.10c Z-test result of farmers' perceived individual well-being before and after Adoption

Variable	N	Mean	SD	Z-Calculated	Z- Critical	Level of probability
Before	120	223.48	34.63			
After	120	562.90	96.14	19.80	1.64	5%

Consequently, null hypothesis which says that there is no significant relationship between farmers' adoption behaviour and production, income and perceived individual well-being is roundly rejected on the bases of results from Table 4.10a-c. It is therefore concluded that the evidence does suggest that there is a real functional association between adoption of improved maize and cassava technology packages by farmers and production, income and perceived individual well-being in the study area.

CHAPTER 5

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study was conducted in Nkanu East and West LGAs of Enugu State Nigeria, with the main objective to determine adoption of improved maize and cassava technology packages by farmers. Primary data were generated from field survey through structured interview schedule administered to 120 farmers by trained interviewers, supported by oral discussions. The secondary data were obtained from the official records of ENADEP's extension agents in the two LGAs as well as IAR and NAERLS' libraries and internet. Descriptive and inferential statistics were used to analyse the data which involved the use of means, frequencies, standard deviations and percentages. The results are summarized as follows:- The main sources of information patronized by the farmers across all technologies and practices included in the study were: radio which with 84.40% patronage ranked first while television came second with 73.69% assent, and extension service with 69.29% ranked 4th. GSM phone scored the least with 25.11% use by the farmers. Findings also showed that farmers with households consisting of 6-10persons/household constituted 63.33% and 51.67% of the respondents owned land of 1-3ha/farm household while about 51.67% had between 8-14 years farming experience. Almost half of the farmers (44.20%) belonged to 3-4 social groups/person with each farmer belonging to at least one social organization. On extension contacts 52.50% had only three times contact with extension agents for the whole 12 months preceding the year of this study. It was found that 94.17% listen to agricultural programmes on radio while 54.17% watch agricultural programmes on television and 53.33% read agricultural publications. Two

attributes of the innovation, namely compatibility and complexity were affirmed by 72.50% and 81.67% of the respondents respectively.

Results from awareness and adoption rates and levels were relatively high. Awareness rate in 2004-2005 cropping season was 10% and rose to 28% in the study year (2008-2009) while adoption rates rose from 7% in 2005-2006 to 23% in 2007-2008 cropping season, but only to decline by 3% in the study year to 20%. On levels of awareness 93.33% of the respondents affirmed having heard of improved maize and cassava cultivars, slanting method of planting cassava cuttings and use of mounds while 90.83% were aware of use of organic fertilizers. The least scores were 3.33% against horizontal and vertical methods of planting cassava sticks, while 95% favoured manual weeding.

Result of coefficient of correlation showed that 12 independent variables considered in the study were related to adoption at $p<.05$ and $p<.01$, while regression analysis proved that the major determinants of adoption of the innovations in the area were group membership, mass-media exposure and compatibility at $p<.05$; as well as farming experience, extension contact and complexity which were also significant at $p<.01$. On effects of adoption on the respondents' production, income and perceived individual well-being, results showed that there were notable scaling up by 29.17%, 30.83% and 33.33% in production, income and perceived well-being levels respectively after adoption of the technology packages. However, most respondents raised issues about the constraints they faced such as insufficiency in supply of inputs, for example inorganic fertilizers and improved cultivars, absence of credit linkage, youth's aversion to farm work, among others. The three null hypotheses formulated for

the study were found to be untenable, hence they were rejected and alternatives accepted.

5.2 Conclusion

Based on the findings of this study, it can be deduced that the main information sources on improved maize and cassava technology packages used by farmers in the area are: radio, television, friends and relatives and extension agents, in that order. Thus, stakeholders can henceforth avail themselves of empirical knowledge as to the fastest means to reach their target audiences in the study area. G.S.M. phone which ranked least has great potential to become a credible source of agricultural information dissemination in the near future. Factors such as farming experience, extension contact, mass media exposure and group membership were found to influence adoption of the technology packages, thereby suggesting their importance for effective adoption of improved maize and cassava technology packages in the area. Consequently, it can be inferred that the more experienced the farmers are, the higher the number of extension contacts, the more the number of mass media channels utilized (especially radio and television), and the more innovations are channelled through social organizations, the more adoption of innovations could be guaranteed in the area. Extension result showed that about half of the respondents had only 3 times contact with extension agents in the preceding year, implying that extension service is weak. However, farm size and household size factors which failed to impact on adoption can be attributed to labour availability in farm households. Equally notable is that respondents may not be under pressure to take loans to pay for labour nor hire tractors to plough their fields. This is because of availability of labour force, male and female, for making of mounds and hoe weeding within the social groups farmers belong to.

Two attributes of the innovation (viz compatibility and complexity) from results influenced adoption. This indicates that the two attributes should constantly be emphasized by extension agents in their method demonstrations and promotions. Obviously, technologies which are not appropriate and easy to handle are not likely to command high awareness and adoption rates and levels among farmers.

However, the major constraints the farmers encountered were insufficiency in supply of inputs (e.g. fertilizers, hybrid maize seeds and improved cassava stems), non-availability of tractors for hiring, insufficient lands for production, non-availability of credit as well as markets to sell their fresh cassava roots, among others. The improved technology packages having been shown to be quite beneficial, it suggests that without adequate provision of inputs at the right time and in the right quantities, access to effective marketing channels, patronage and good roads for the people, the entire idea may turn counter-productive. The popularity manual weeding currently enjoys in the area is worrisome and draws attention to the need for drudgery-reduction educational programme for the farmers in the area.

Finally, this study has largely presented a detailed review of adoption of improved maize and cassava technology packages in the study area, together with the positive influence of such factors as farming experience, extension contact, mass media exposure and group affiliation, as well as compatibility and complexity attributes thereto.

5.3 Recommendations

Based on the findings of the study the following recommendations are made to advance adoption of improved maize and cassava technology packages in the area:

i. Those factors and innovation attributes that contributed to adoption should be captured in future planning of agricultural projects in Enugu State, particularly in the study area.

ii. In view of identified constraints in which 91.67% of the farmers expressed dissatisfaction with lack of access to inorganic fertilizers and 75.00% of the farmers complained of lack of tractors for hiring, among others, government should intervene by establishing agro-service centres at strategic locations that are adequately stocked with inputs to be sold to the farmers at subsidized rates, so as to fast-track commercial agriculture in the study area.

iii. Since landholding per farm household in the area was found to be largely 4.13ha, government can move in to help the farmers with tractors and implements to enable them plough, harrow and ridge their fields.

iv. Given that farmers' social participation was encouraging and each respondent belonged to at least one social organization, agricultural information, credit and inputs can safely be channelled through those organizations to the farmers.

v. As some of the respondents (25.83%) mentioned the problem of inability to handle herbicides, government should ensure that farmers in the area are

educated by extension agents on use of herbicides, after the soil and rainfall would have been examined thoroughly (CTA, 1987).

vi. That the radio be relied upon as a veritable tool for agricultural information dissemination in the area.

5.4 Suggestions for Further Research

i. A replication of this study topic could be conducted in one or two other Local Government Areas of the State for a wider coverage and robustness of the information to be gathered. This will enhance generalization of recommendations on adoption of the technology packages in the State.

ii. A post-adoption study can equally be carried out so as to evaluate what changes that must have taken place as a result of the adoption of the improved maize and cassava technology packages in the area.

iii. There is need to investigate factors militating against job performance of extension agents in the area.

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APPENDIX I

INTERVIEW SCHEDULE

Name of interviewer……

Date of interview…….

Name of village……...

Respondent's No……

INTRODUCTORY NOTE

Good day dear friend. I am a student in the Faculty of Agriculture, Ahmadu Bello University (ABU), Zaria and currently carrying out a research on Adoption of Improved Maize and Cassava Technology Packages in your village. I would be grateful if you will kindly help me by answering the questions in the interview schedule. The information provided here will help the state government, ENADEP and private organizations to find ways of helping you and other farmers engaged in maize and cassava production. Please feel free and answer the questions honestly.

You are guaranteed every confidentiality on the information supplied and please note that this research has nothing whatsoever to do with tax assessment.

Thank you.

EDE DOUGLAS
(Researcher)

SECTION (A): Sources of Information on the innovations

1. Name of respondent _____

2. Which are your sources of information on the following improved maize and cassava technology packages as listed in Table below? Yes / No.

	Technologies / Practices		Sources of Information
a	**Improved maize seeds and cassava cuttings**	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Market place Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publication Yes [ ] No [ ]
		8	Agric organization and community – base groups Yes [ ] No [ ]
		9	Others (specify) _____
b	**Seed- bed preparation**		
	i. Ploughing after 3 weeks	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____
	ii. Harrowing	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Market place Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publication Yes [ ] No [ ]

		8	Agric organization and community – base groups Yes [ ] No [ ]
		9	Others (specify) _____
	iii. Flats	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – base groups Yes [ ] No [ ]
		9	Others (specify) _____
	iv. Ridging immediately after harrowing	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____
	v. Mounds	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____

c	**Planting method and spacing** i. Planting cassava cuttings: vertically / horizontally / slanting	1 2 3 4 5 6 7 8 9	Radio Yes [ ] No [ ] Television Yes [ ] No [ ] GSM phone Yes [ ] No [ ] Marketplace Yes [ ] No [ ] Friends and relations Yes [ ] No [ ] Agric ext. agent Yes [ ] No [ ] Agric ext. publications Yes [ ] No [ ] Agric organization and community – based groups Yes [ ] No [ ] Others (specify) _____
	ii. Planting maize seeds: 2 seeds / hole, 2-5cm deep on one side of the ridge ½ way between 2 cassava stands	1 2 3 4 5 6 7 8 9	Radio Yes [ ] No [ ] Television Yes [ ] No [ ] GSM phone Yes [ ] No [ ] Marketplace Yes [ ] No [ ] Friends and relations Yes [ ] No [ ] Agric ext. agent Yes [ ] No [ ] Agric ext. publication s Yes [ ] No [ ] Agric organization and community – based groups Yes [ ] No [ ] Others (specify) _____
	iii. Spacing (for maize and cassava) 1 mx1m	1 2 3 4 5 6 7 8 9	Radio Yes [ ] No [ ] Television Yes [ ] No [ ] GSM phone Yes [ ] No [ ] Marketplace Yes [ ] No [ ] Friends and relations Yes [ ] No [ ] Agric ext. agent Yes [ ] No [ ] Agric ext. publication s Yes [ ] No [ ] Agric organization and community – based groups Yes [ ] No [ ] Others (specify) _____

d	**Crop population**		
	i. Maize 25-30kg/ha	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publication s Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____
	ii. Cassava: 10,000-20,000pts/ha	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____
e	**Weed control**		
	i. Herbicide: immediately after planting	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____
	ii. Manual: 3-4 x 8 x 12 WAP	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]

		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____
f	**Fertilizer application**		
	i. Inorganic (maize): 6-8 bags/ha 2-3 WAP	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____
	ii. Inorganic (cassava): 6-8 bags/ha 8 WAP	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____
	iii. Organic (maize and cassava): Regularly	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]

		9	Others (specify) _____
g	**Harvesting**		
	i. Maize: Green / Dry	1	Radio Yes [ ] No [ ]
		2	Television Yes [ ] No [ ]
		3	GSM phone Yes [ ] No [ ]
		4	Marketplace Yes [ ] No [ ]
		5	Friends and relations Yes [ ] No [ ]
		6	Agric ext. agent Yes [ ] No [ ]
		7	Agric ext. publications Yes [ ] No [ ]
		8	Agric organization and community – based groups Yes [ ] No [ ]
		9	Others (specify) _____
	ii. cassava: 10-12 MAP		Radio Yes [ ] No [ ] Television Yes [ ] No [ ] GSM phone Yes [ ] No [ ] Marketplace Yes [ ] No [ ] Friends and relations Yes [ ] No [ ] Agric ext. agent Yes [ ] No [ ] Agric ext. publications Yes [ ] No [ ] Agric organization and community – based groups Yes [ ] No [ ] Others (specify) _____

3. If No, why? _____

_____

N.B. WAP : Weeks after planting

MAP : Months after planting.

SECTION B: FACTORS AFFECTING ADOPTION

4. (Household size): How many people are in your family including yourself? [ ]

5. (Size of the farm): What is the size of your farm? [ ]

6. (Farming experience): How many years have you been farming? [ ]

7. (Group membership): How many social organizations do you belong to? [ ]

8. (Extension contact): Is there any extension agent in your village? Yes/No

9. If yes how many times did he/she visit you during the last season?

   i. Once [ ]

   ii Two times [ ]

   iii 3 times [ ]

   iv. 4 times [ ] (Tick one)

   v. Others (specify)_____

10. How many times did you visit him/her during the last season?

   I Once [ ]

   ii Two times [ ]

   iii 3 times [ ]

   iv 4 times [ ] (Tick one)

   v. Others (specify).....

11. If No, why?

12. (Mass Media exposure): Do you listen to agricultural programmes on radio? Yes [ ] No [ ]

13. If Yes, do you take to their advice? Yes [ ] No [ ]

14. If Yes, Why? _____

15. If No, why?_____

16. Do you watch agricultural programmes on TV? Yes [ ] No

17. If Yes, do you practise what the presenter teaches? Yes [ ] No [ ]

18. If Yes, why?_____

19. If No, why?_____

20. (Innovation attributes): Did you use improved maize/cassava technology packages in the last season? Yes /No/No opinion/ (Pls turn to next page)

21. If Yes, answer questions 22-27 in the boxes below:

Technologies	**22**. Do you agree that the technology packages are superior to the existing practices? **(Relative advantage)**			**23**. Do the technology packages conform with society's culture? **(Compatibility)**			**24.** Are the technology packages easy to understand and handle? **(Complexity)**			**25.** Are the technology packages testable? **(Trialability)**			**26.** Are the results of use of the technology packages clearly visible? **(Observability)**			**27.** Are the technology packages readily available? **(Availability)**		
	Yes	No	No opinion	Yes	No	No opin	Yes	No	No opin	Yes	No	No opin	Yes	No	No opin	Yes	No	No opin.
(a) **Improved maize seeds and cassava cuttings**																		
(b) **Seed-bed preparation**																		
i. Ploughing (after 3 weeks)																		
ii. Harrowing																		
iii. Flats																		
iv. Ridging: immediately after harrowing																		
v. Mounds																		
(c) **Planting method and spacing**																		
i. Planting cassava cuttings: vertically/horizontally/slanting																		
ii. Planting maize seeds: 2 seeds/hole, 2-5cm deep on one side of the ridge or mound ½ way between 2 cassava stands.																		
iii. Spacing (for both maize and cassava): 1m x1m																		
(d) **Crop population**																		
i. Maize: 25kg/ha { } 30 kg/ha { }																		
ii. Cassava: 10,000 – 20,000 pts/ha.																		
(e) **Weed control**																		
i. Herbicide: immediately after planting																		
ii. Manual: 3-4 x 8 x 12 WAP																		
(f) **Fertilizer application**																		
i. Inorganic (maize): 6-8 bags/ha2-3 WAP																		
ii. Inorganic (cassava): 8 WAP																		
iii. Organic (maize and cassava): Regularly																		
(g) **Harvesting**																		
i. Maize: Green { } Dry { }																		
ii. Cassava: 10 MAP { } 11 MAP { } 12 MAP { }																		

28. If no/ no opinion, why? _____

_____

SECTION C: AWARENESS OF THE INNOVATIONS

29. As at the last planting season, were you aware of the following, improved maize and cassava technology packages as listed in the table below?

Yes [ ] No [ ]

When? 2004-2005 [ ] 2005-2006 [ ] 2006-2007 [ ]

2007- 2008 [ ] 2008-2009 [ ]

	Technologies / Practices	**Awareness**	
a	**Improved maize seeds and cassava cuttings**	Yes [ ]	No [ ]
b	**Seed-bed preparation**		
	vii. Ploughing: after 3 weeks.	Yes [ ]	No [ ]
	viii. Harrowing	Yes [ ]	No [ ]
	ix. Flats	Yes [ ]	No [ ]
	x. Ridging: immediately after harrowing	Yes [ ]	No [ ]
	xi. Mounds	Yes [ ]	No [ ]
c	**Planting method and spacing**		
	i. Planting cassava cuttings	Vertically [ ] Slanting [ ]	Horizontally [ ] (Tick one)
	ii. Planting maize seeds: 2 seeds/hole, 2-5cm deep on one side of the ridge or mound ½ way between 2 cassava stands	Yes [ ]	No [ ]
	iii. spacing (for both maize and cassava)	Yes [ ]	No [ ]
d	**Crop population**		
	xii. Maize	25kg/ha [ ]	30kh/ha [ ]
	xiii. Cassava	10,000 pts/ha [ ] 20,000pts/ha	(Tick one) 15,000 pts/ha [ ] (Tick one)
e	**Weed control**		
	xiv. Herbicide: immediately after Planting.	Yes [ ]	No [ ]
	xv. Manual 3-4 x 8 x 12 WAP	Yes [ ]	No [ ]

f	**Fertilizer application** xvi. Inorganic (maize): 6-8 bags/ha 2-3 WAP. xvii. Inorganic (cassava): 6-8 bags/ha 1-8 WAP. iii. Organic (maize & cassava) regularly.	 Yes [ ] Yes [ ] Yes [ ]	 No [ ] No [ ] No [ ]
g	**Harvesting Time** xviii. Maize xix. Cassava	 Green [ ] Dry [ ] 10 MAP [ ] 11 MAP [ ] 12 MAP [ ]	

30. If No, why?_____

_____

SECTION D: ADOPTION OF THE INNOVATIONS

31. As at last season, had you adopted improved maize and cassava technology packages as listed in the Table below? Yes / No

When? 2004-2005 [ ] 2005-2006 [ ] 2006-2007 [ ]

2007- 2008 [ ] 2008-2009 [ ]

	Technologies / Practices	**Adoption**	
a	**Improved maize seeds and cassava cuttings**		
	xx. Seed-bed preparation.	Yes [ ]	No. [ ]
	xxi. Ploughing: after 3 weeks	Yes [ ]	No. [ ]
	xxii. Harrowing	Yes [ ]	No. [ ]
	xxiii. Flats	Yes [ ]	No. [ ]
	xxiv. Ridging: immediately after harrowing Mounds	Yes [ ] Yes [ ]	No. [ ] No. [ ]
c	**Planting method and spacing**		
	xxv. Planting cassava cuttings	Vertically [ ] horizon-tally[ ]	
	xxvi. Planting maize seeds:	Slanting [ ] (tick one)	
	2seeds / hole, 2-5cm deep on one side of the ridge or mound ½ way between 2 cassava stands.	Yes [ ] No. [ ] Yes [ ] No. [ ]	
	xxvii. Spacing (for maize and cassava): 1, m x 1m		

d	**Crop population** xxviii. Maize xxix. Cassava	25kg/ha [ ] 30kg/ha [ ] (tick one) 10,000pts/ha [ ] 15,000pts/[ ] 20,000 pts/ha [ ] (tick one)
e	**Weed Control** xxx. Herbicide: Immediately after planting. xxxi. Manual 3-4 x 8 x 12 WAP	 Yes [ ] No [ ] Yes [ ] No [ ]
f	Fertilizer application xxxii. Inorganic (maize): 6-8 bags/ha 2-3 WAP. xxxiii. Inorganic (cassava): 8 WAP. ii. Organic (maize and cassava): Regularly	 Yes [ ] No [ ] Yes [ ] No [ ] Yes [ ] No [ ]
g	Harvesting time: (tick one) xxxiv. Maize xxxv. Cassava	 Green [ ] Dry [ ] (tick one) 10MAP [ ] 11MAP [ ] 12MAP [ ]

32. If No, why_____

_____

SECTION E: EFFECTS OF ADOPTION OF THE INNOVATIONS

33. **(Production):** Which of the following yield ranges, before and after adoption of improved maize and cassava technology packages in the last season reflect your level of production?

(Before)		**(After)**	
a) Less than 3 tonnes / ha	[ ]	a) Less than 3 tonnes/ha	[ ]
b) 2-4 tonnes/ha	[ ]	b) 2-4 tonnes/ha	[ ]
c) 5-7 tonnes/ha	[ ]	c) 5-7 tonnes/ha	[ ]
d) 8-10 tonnes/ha	[ ]	d) 8-10 tonnes/ha	[ ]
e) 11-13tonnes/ha	[ ]	e) 11-13tonnes/ha	[ ]
f) 14 tonnes / ha and above	[ ]	f) 14 tonnes / ha and above	[ ]

34. **(Income):** Which of the following income ranges, before and after adoption of improved maize and cassava technology packages adequately reflect your own situation/ha?

(Before)	**(After)**
a) Less than N10,000 [ ]	a) Less than N10,000 [ ]
b) N10,001-N15,000 [ ]	b) N10,001-N15,000 [ ]
c) N15,001-N20,000 [ ]	c) N15,001-N20,000 [ ]
d) N20,001-N25,000 [ ]	d) N20,001-N25,000 [ ]
e) N25,001-N30,000 [ ]	e) N25,001-N30,000 [ ]
f) N30,001abd above [ ]	f) N30,001abd above [ ]

35. Which of the following items did you own before and after adoption of improved maize and cassava technology packages? **(Before)**

xxxvi. Radio: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xxxvii. Television: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xxxviii. Bicycle: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xxxix. Motor bike: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xl. VCD/DCD players Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xli. Air conditioner: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xlii. Refrigerator / deep freezer: Yes [ ] No [ ]Number owned[ ] Year acquire

xliii. Ceiling/ standing fan: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xliv. Others specify _____

_____

(After)

xlv. Radio: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xlvi. Television: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xlvii. Bicycle: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xlviii. Motor bike: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

xlix. VCD/DCD players Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

l. Air conditioner: Yes [ ] No [ ]Number owned [ ] Year acquired [ ]

li. Refrigerator / deep freezer: Yes [ ] No [ ]Number owned [ ] Year acquire

lii. Ceiling/ standing fan: Yes [ ] No [ ]Number owned [ ] Year acquired [

liii. Others specify _____

_____

36 **(Perceived individual well-being):** How happy were you with your farming before and after adopting improved maize and cassava technology package?

(Before)		**(After)**	
i. Very happy	[ ]	i. Very happy	[ ]
ii. Happy	[ ]	ii. Happy	[ ]
iii. Unhappy	[ ]	iii. Unhappy	[ ]
iv. Very unhappy	[ ]	iv. Very unhappy	[ ]

Score: Very happy : 4pts Happy : 3pts Unhappy : 2pts Very unhappy : 1pt.

SECTION F: ADOPTION CONSTRAINTS TO THE FARMERS

37. Do you experience any problem in adopting improved maize and cassava technology packages? Yes/No

38. If yes, tick as appropriate:

a) There is not enough land available to me for production [ ]

b) Fertilizers are not available and where they are, are very costly [ ]

c) There is lack of contact with extension agent [ ]

d) No money to buy inputs and to pay for labour [ ]

e) My children don't want to help me with farm work [ ]

f) No tractor for hiring [ ]

g) No sufficient hybrid maize seeds and cassava cuttings to buy [ ]

h) No market for fresh cassava roots [ ]

i) No cassava processing facility within reach [ ]

j) Others (specify)_____

_____

_____

_____

_____

39. If No, why? _____

_____

_____

APPENDIX II

Correlation matrix showing the relationships between variables

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	Y
Household size** X_1	1.00												
Farm size** X_2	.464	1.00											
Farming experience* X_3	-002	.041	1.00										
Group membership** X_4	-.118	.349	.504	1.00									
Extension contact* X_5	-.217	-.166	.156	.314	1.00								
Mass media exposure** X_6	.222	.065	.066	.135	.109	1.00							
Relative advantage** X_7	.077	.034	.182	.418	.184	.187	1.00						
Compatibility** X_8	.090	.058	-.017	.292	.493	.087	.484	1.00					
Complexity* X_9	.183	.396	.038	.256	.189	.258	.144	.453	1.00				
Trialability** X_{10}	.237	-.015	-.018	-.049	.184	.361	.307	.308	.190	1.00			
Observability** X_{11}	.040	.054	.081	.258	.258	.334	.313	.453	.557	.467	1.00		
Availability* X_{12}	.250	.343	.243	.625	.341	.228	.479	.339	.493	.200	.326	1.00	
Adoption Y	.426	.210	.621	.523	.742	.411	-.209	-.541	.603	.225	.318	-.284	1.00

**Correlation is significant at 5% level (2-tailed)

*Correlation is significant at 1% level (2-tailed)