FACTORS INFLUENCING ADOPTION OF IMPROVED MAIZE TECHNOLOGIES AMONG FARMERS IN GIWA LOCAL GOVERNMENTAREA, KADUNA STATE, NIGERIA

BY

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A THESIS SUBMITTED TO POST GRADUATE SCHOOL, AHMADU BELLO UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY.

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DECLARATION

I hereby declare that this thesis was written by me and that it is a record of my research work, it has not been presented before in any application for a higher degree or reputable presentation elsewhere. All borrowed ideas are duly acknowledged by means of references and quotation marks.

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CERTIFICATION

This thesis entitled "FACTORS INFLUENCING ADOPTION OF IMPROVED MAIZE TECHNOLOGIES AMONG FARMERS IN GIWA LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA" by UBANI, Charles Onyemaechi, meets the regulation governing the award of the degrees of Masters of Science of Ahmadu Bello University Zaria, Kaduna State, Nigeria, and is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to the Almighty God for the Grace He granted unto me of which if not, I would not have made this far. More affectionately, I also dedicate this research work to my family; my wife Mrs. Elizabeth Ojoma Adejoh-Ubani, my children, Joshua, Joseph, Josiah and Joana, who gave me peace, quietness and immense supports when studying after the day's activities.

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ABSTRACT

The study was carried out to study the socio-economic and institutional factors influencing the adoption of improved maize technology among farmers in Giwa Local Government Area of Kaduna State. Data were collected using structured questionnaire from the respondents who major on maize production. A total strength of 631 farmers constituted the sample frame. Out of which 20% of respondents were purposively selected from each wards of the Local Government Area for the study bringing the total number of sample size to 126. Both descriptive statistics (involving the use of percentage and frequency) and Multiple Regression Model were used for the analysis. The result showed that four variables were found to be significant in relation to the adoption of improved maize technologies. These variables include education, farm size, household size and gender of the respondents. Going by the aforementioned indicator, farm activities in the study area is subsistence as majority of the respondents 50% was able to produce between 30-80 bags. The study revealed low output by majority of respondents resulting from incomprehensive diffusion and adoption process. This study was able to identify lack of homogeneity as a prime factor that hinders bumper maize harvest such as: identification of needs, priorities and preferences of the farmers in the study area. To ensure food security in the study area, this work recommended that there should be some level of capacity building. This has to do with intensive training and retraining on better ways of managing the soil through effective disease/striga control measures before adopting the improved technologies by these farmers who are mainly subsistence farmers.

CHAFTER ONE

1.0 Introduction

1.1 Background

The vital role of agriculture in the development of the economies of Third World nations, including Nigeria is undeniable (Eastwood *et al* 2006 Agriculture accounts for over 70% of the non-oil export and provides over 80% of the food needs of the country. Nigeria has a total land area of 98.3million hectares or 48% are under cultivation. Agriculture is practiced at subsistence level in Nigeria. This is characterized by numerous farmers operating several scattered small and fragmented plots of land using traditional methods like land rotation and bush burning and crude implements like hoes and cutlass (Adegboye, 2004). The sector is almost entirely dominated by small scale resource poor crop producers living in rural areas.

Emphasising the role of agriculture in rural development, Abel, (2005) affirmed that agriculture is the engine of growth for poor countries and poor people, and agricultural development is one of the most effective ways to alleviate hunger and poverty. Slow growth in agricultural production has been a serious problem in Sub-Sahara Africa, challenging domestic and international policymakers. According to Acoba, (2000) agricultural development is a complex process that is affected by the interaction and inter-related of many factors. These factors range from natural resource endowment in a respective area. As part of agricultural development in a certain agro-ecosystems, the business involves the use o appropriate technology packages, the provision of farm inputs, and the existence of infrastructural and supporting institutions such as financial and extension institutions, post-harvest and marketing services of agricultural products. Similarly, Soentoro and Hermento, (2000)

affirmed that intensifying agricultural technology transfer without improving infrastructures and creating enabling environment for farmers to adopt the technology would not solve the main problem of food security. Similarly, Odebode, (2007) stated that agriculture is a major sector of Nigeria's economy as it provides food and processed products for the population as well as provision of raw materials for agro-allied industries.

Rising income of much of the developing countries and the consequent growth in meat and poultry consumption have resulted in a rapid increase in the demand for maize as livestock feeds. This trend is particularly evident in East and Southeast Asia, where maize requirements are projected to rise from 150million tons in 1995 to 280million in 2020 (IFRI, 2000). Meanwhile, in the least developed parts of the world, unabated population growth and the persistence of poverty have maintained upward pressure on the demand for food maize; this is the case in Sub-Saharan Africa, Central America, and parts of South Asia. Annual maize demand in Sub-Saharan Africa is expected to double to 52million tons by 2020. The exploding demand for maize presents an urgent challenge for most developing countries, like Nigeria with large populations; the accelerating demand for maize increase in domestic supply, future output growth must come from intensifying production on current maize land (IFRI, 2000).

To improve the agricultural production such as maize, some form of appropriate technologies are necessary. Studies in maize production in different parts of Nigeria have shown an increasing importance of the crop amidst growing utilization by food processing industries and livestock feed mills.

Maize (*Zea mays*) is a major stable cereal crop of great importance in many countries of Sub-Saharan Africa (SSA). Maize has been in the diet of Nigerians for centuries. It is third most important cereal crop after Sorghum and Millet. Similarly, Porter, (2006) stated that maize

consumption was formerly considered a poor man's food, but recent consumption patterns indicate maize as a major stable food in almost every household in Nigeria, especially by low and middle income groups. Porter, (2006) further reported that since the ban on importation of cereals by the Federal Government of Nigeria in 1986, there has been an increasing demand for maize by households and agro-allied industries in Nigeria. As a cash crop, it has been used to substitute for imported grains, flour, Kuskus, baby foods, confectionaries animal and livestock feeds. It is worthy to note that Maize technologies had contributed significantly to some dimensions of members' well being and if technologies are adopted sustained with full use of recommended inputs, it can alleviate the problem of peasant farmers and will obviously boost food production (Sasakawa 2000, (2006).

Appropriate technologies in this context are defined as the latest scientific and technological development that has been adjusted to suit the local conditions to the highest possible degree FAO, (1996).

1.2. Statements of the problem

According to IITA 2007**,** maize which constitutes a major stable food crop in Nigeria and even in Africa has in the recent times suffered low productivity. IITA, (2007) further buttressed that the factors that could have been responsible for the low productivity could be attributed to inadequate application and use of recommended improved maize technologies. According to IITA, (2007), increased productivity from 1984 was due to increase in land under cultivation rather from intensive cultivation. A number of factors could have been responsible for the low productivity, these includes little or no use of improved seeds, herbicides and fertilizers, increased levels, or biotic and a biotic constraints and the fact that prices of imputes have triple in the last ten years.

IITTA, (2007) further reported that global warming and its associated effects have changed rainfall pattern leading to erratic and unreliable rainfall in some cases resulting in drought. Furthermore, the little or no use of fertilizer or organic manure has resulted on soils becoming poorer with an opportunistic expansion or striga infestation problems. Continuous growing of crop for cash also results to build-up and carryover of pests notably stems borers from one crop to the next within the same environment. Farmers in the study area have access to these improved maize technologies to increase production; such as improved seeds, seed dressing, appropriate method of pest/disease control, appropriate quantity of organic and inorganic fertilizer, appropriate planting spacing, and appropriate method of fertilizer application. The farmers in the study area have not been able to take adequate advantage of these technologies as a result to low income, low savings, low capital, low investment, lack of entrepreneur skills, and low output- a concept often referred to as the vicious cycle of poverty (Nwagbo *et al.*, 1989). Based on this, average maize yields are low below the potential of this study area. This low production has created serious food deficits.

It is against this background that this study intends to answer the following research questions.

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

ii. What are the sources of information to farmers in the study area?

iii. What are the factors influencing the adoption of the improved maize technologies by farmers in the study area?

iv. What are the effects of adopting the improved technologies on farmers in terms of output, income and level of living in the study area?

v. What are the constraints that farmers faced in the adoption of the improved maize production technologies in the study area?

1.3 Objectives of the study

The main objective of this study is to gain an insight on factors influencing the adoption of improved maize production technologies among farmers in Giwa Local Government Area of Kaduna State, Nigeria:

The specific objectives are to:

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

ii. identify the sources of information to farmers in the study areas;

iii. identify factors influencing the adoption of the improved maize technologies by farmers in the study area?

iv. determine the effect of adopting the improved technologies on farmers' yield, income and level of living before and after adoption in the area; and

v. Identify the constraints that farmers faced in the adoption of the improved maize production technologies in the study area.

1.4 Hypothesis of the study

HO: There is no significance relationship between socio-economic variables of the respondents and their adoption of improved maize technologies among farmers.

1.5 Justification of the study

Firstly, the cultivation of maize was formerly for subsistence purpose, but it has gradually become an important commercial crop in which many agro-allied industries depend on as the raw materials. Since farmers' contributions to availability of such raw materials, and hence Nigeria's bid to sustainable food security, effort most therefore be intensified to address all general problem and constraints militating against large scale maize production in Nigeria.

Secondly, the package investigated (improved maize technologies) would enhance productivity, income generation, wealth creation, poverty reduction and ameliorate the current food insecurity confronting the study area and Nigeria in general.

Thirdly, the study will strengthen farmers' linkages for intensive maize production in the subsequent farming seasons. Also would provide required data on the current adoption status of the farmers. It will also provide both researchers and extension workers with relevant information on farmers' socio-economic characteristics influencing adoption of the technology package and other individual decisions.

Finally, it is hoped that the study would give an insight to the Local Government, Kaduna State Agricultural Development Programme, national and international agencies on the importance of encouraging farmers to pro-active towards adoption of these improved farm practices for cost reduction, training and retraining of farmers to refresh ideas. It is based on this note that this study was designed to investigate how the socio-economic characteristics of farmers could affect their relationship to the adoption of improved technologies on maize production.

Chapter Two

2.0. Literature Review

2.1 Socio-Economic Determinants of Adoption of Improved Agricultural Technologies.

Studies on socio-economic characteristics of farmers carried out in Nigeria and elsewhere have shown that there exists a close association between farmers' socio-economic characteristics and awareness of adoption of improved agricultural technologies. Odoemenem and Obinne, (2010) investigated that relationship between the adoption index and the frequency of extension agents contact with the farmers to be positive. This is because constant meeting between the extension personnel and the farmers would enlighten the adopter (the farmer) and create awareness for the potential gains of improved agricultural innovation. The expectation is that the young farmers will be more prone to adopting latest improved agricultural technologies than the older farmers.

Farmers' adoption of a new technology, such as improved maize technologies is a choice between decision to adopt or not to adopt is usually based on the profitability and risk associated with the new technology. Before adoption, farmers have to be assured of the expected marginal gains and associated risk. The farmers' concern with marginal gains and risk in turn affects the adoption of the new technology. Most adoption studies under small holder production system show that farmers are risk averse and follow a technological ladder in the adoption process. They will first adopt simple components and then more complex ones, and from cheaper to more costly technologies. The process allows farmers to evaluate available alternative to avoid having unnecessary costs (CIMMYT, 1988). Among the many factors that contribute to growth in agricultural productivity, technology is the most important. The rate of adoption of a new

technology is subject to its profitability and the degree of risk and uncertainty associated with it, and is highly influenced by the capital requirement, agricultural policies, and the socio-economic characteristics of farmers. Producers benefit from the adoption of new technology through opportunities to lower production costs, either by increasing outputs from the same inputs or by maintaining the same output from reduced inputs. New technology, such as new improved maize technologies may change the optimal levels of inputs used. Widespread adoption of new production technology by farmers might also be expected to have important market effects. Market-level impact can then be estimated by aggregating the farm responses, based on an assumed national adoption level (Nassif, 1999).

Level of education is the number of years an individual farmer actually spent in formal school. This denotes that a farmer who attended primary school and completed secondary school, the numbers of years spent for the two levels will be summed together. This assertion agrees with the work of Agbamu and Orborhoro, (2007) that investigated and found that when farmers spend more years in formal school, they become more competent in reading and writing. Therefore, the adoption index is expected to be positively related to the level of formal education. Formal education contributes significantly to the adoption of improved agricultural technologies. Literatures also review that a farmer status in terms of his assets, wealth, and population of the family, farm size, income, extension contact, and the exposure are among the indices that determine the acceptance and the adoption of improved farming practices. According to Adeniji, (1996) who studied the impact of mass media on adoption of agricultural innovation and finds that socio-economic factors such as age, household size, formal education, farm size, income, cosmopolitanism and community status were related to adoption.

Household size is the total number of individual (wives, children or grand children and extended family members) that live with and feed from the household. The adoption index may

be either household size depending on age structure and available farm labour among members. According to Adesina and Baidun-Forson, (1995) revealed that farmers adopt agricultural innovations because they have more mouth to feed while the family serves as labour source for agricultural production.

Land ownership structure is a prime factor towards determining adoption of new technology package. Ekong, (2005) maintained that farmers can be indifferent in adopting new technologies if the land tenure system does not allow personal ownership of land to execute the technology. In Nigeria, Ekong (2005), Ajayi and Ogunlela (2006), reported that land acquisition in most cases is through inheritance, allocation and gifts, sales, pledges, lease, purchase and loans. They pointed the pressure on land as a result of increasing population can lead to individual ownership of land and fragmentation of farmland. Sources of information on improved technology play an important role in adoption of any improved agricultural technology by the farmers.

Credit availability to the farmer will lead to adoption of modern technology. Agbamu *et al* (1996) affirmed that credit is vital to agricultural transformation. It contributes to the farmers' social welfare, enhances production, and helps in capital formation and sustainability of income. Ogunmameru (2008) had identified the sources of information to farmers to include extension workers, fellow farmers, and neighbors and mediated information sources. The primary objectives of the informants are to create awareness by diffusing among potential adopters useful and practical information on the innovation and encourage its application. Ekong, (2005) also affirmed that such technical information are very useful during the trial stage of adoption process and are capable of leading to adoption of agricultural innovations.

2,2 Farmers Sources of Information on Improved Agricultural Technologies

One of the ways of achieving the role of the agricultural sector in Nigeria's economy is through effectiveness of information sources on improved farms practices. Odebode, (2007). Agricultural information can be viewed as a process of communicating ideas, skills and technology from extension to farmers; the importance of such information is an ingredient for advancement of agriculture cannot be over emphasized as its inadequacy could be dangerous and form to become major constraints to agricultural development (Adeola, 2008).

However, effective communication is seen as an essential tool for the establishment and maintenance of good social and working relationships and it enables people to exercise control over their environment (Braimoh, 1988; Anyanwu, 1992). The purpose of communication is to bring about change of attitude, knowledge, skills and aspiration of the receivers. In Nigeria, various communication media are being used to transmit agricultural information to famers in line with national policy on agriculture. The communication media include farm magazine, leaflets, newsletters, newspapers, pamphlets, radio and television, among others (Dare, 1990). Among them, radio is the most preferred tool of mass communication in Nigeria (Zaria and Omenesa, 1992; Omenesa, 1997; Ekumankama, 2000).

Omenesa, (1997) observed that radio programme is usually timely and capable of extending messages to the audience no matter where they may be as long as they have a receiver with adequate supply of power. The absence of such facilities as road, light and water are no hindrance to radio. Similarly, such obstacles as difficult topography, distance, time and socio-political exigencies do not hinder the performance of radio. He further observed, that illiteracy is no barrier to radio messages since such messages can be passed in the audience own language. Another advantage of radio programme is that it can be done almost anywhere through the use of a tape recorder (Nwuzor, 2000). It is probably because of these advantages of radio that many

governments accord high priority to it as a means of reaching farmers on improved agricultural practices. Okunlola, (2003) reported that farmers obtained their information principally through extension agents and radio. These sources of information cut across all the category of respondents, both literate and illiterate. Rogers, 1964 reported that localized sources of information such as neighbours and friends could play a greater role in diffusion and technology than formal extension services.

2.3 Factors Influencing Adoption of Improved Maize Technology Package by Farmers

Information exposure is most likely to be an important factor influencing their adoption behavior as greater exposure is likely to enhance awareness about the latest recommended and to lead farmers putting these recommended information practice in a precise manner (Muhammad and Gerforth, 1995). A successful and sustainable adoption of technology, the farmers need to be adequately trained by village extension workers on regularly and continuous basis. This is necessary to save farmers from being misguided. Oladosu, (2004) pointed out that adoption and utilization of aggregate technology is largely dependent on the effectiveness and relevance of information dissemination and the ability of extension agents to persuade the farmer.

CIMMYT, (1993) confirmed innovation that are perceived to be economically compatible with farmers' values and resources are often readily adopted. Ijere, (1992) stated that capital is a very important factor of production. Its availability could determine the extent of production capacity, thus, could influence the disposition of the farmers to new ideas or innovations (adoption behavior). A large scale farmer would be expected to adopt better than the small scale's, not only because he possesses better or higher financial capacity but also because he would desire to keep his level of production if not able to increase it. Availability of credit facilities is very crucial to adoption of improved and new ideas in agriculture. Ani, (1999) opined

that it is common to observe among Nigeria farmers that they have relatively small sizes of farms, family labour as the predominant factor. Okoye, (1980) further reported that traditional method of farming predominates in most localities resulting from a personal low input-low output relationship. An attendant low productivity constitutes the hall mark of traditional agriculture as practiced in Nigeria and farming based entirely upon traditional agriculture is inevitably poor.

According to Ani *et al.,* (2008), several factors influence the adoption of agricultural technologies. These include: the needs of the farmers, their levels of education, awareness and income. It is hoped that the higher the relative advantage of the technology, the higher or faster the rate of its adoption by farmers; when a new practice is in agreement with the famers' beliefs and values, the practice will be highly and speedily adopted; the less complex the practice, the easier it is for farmers to understand and adopt; the farmers are able to practice on a small scale, the more readily will it be adopted in full; and if the result of the practice is visible to the farmers, the more they will be convinced and encouraged to adopt more in a greater measure (Ani *et al.,* (2008).

Rogers, (1995) suggested several factors influencing the adoption of agricultural technologies. These he stated as: the needs or wants of the farmers, their level of awareness and level of income. The reasons for non-adoption of improved technologies include inadequate information or knowledge of the technologies on cultural practices such as seed dressing chemicals, planting dates, seed rates, plant spacing, use of herbicides. Obey, (1995) revealed that the ability of farmers to adopt new farm practices depend on their financial positions, nearness to extension personnel as well as nearness to other farmers. Agodan and Jabar (1993) reported that the more knowledgeable the individual farmer, the more favorable attitude he/she has towards

improved technologies. According to Rogers, 1964 wide availability of mass media (television, radio and magazine) is often limited by cost and illiteracy.

2.4 Constraints on maize production to farmers

The yearly production of maize would be elevated, if the constraints were eliminated or minimized. Cardwell *et al.,* (1997), affirmed that losses due to pest and diseases ranged from 20-50% and in the specific case of the grey leaf spot disease, grain yield losses of 90% or more have been reported in several part of the country. Some factors influencing adoption of improved maize are illustrated as follows: diseases and pest, maize post-harvest perishability, high labour requirements, inadequate fertilizer and inorganic fertilizer application, insecticides and pesticides infrastructures such as poor road to convey farm produce, poor communication network, shortage of funds.

Maize production is constrained significantly by rainfall, age, family size and education of household head, access to extension visits, land type either upland or lowland. Absence of seasonal training and retraining of farmers on the challenges of global warming and its attendants consequences on food security, seminars, field demonstration and technical assistant to farmers in order to refresh ideas on contemporary innovations are also constraints to maize production in the study area. FAO, (2000), also reported that the annual rainfall in the Northern Guinea Savannah region is less than 1000mm with attendant long dry season which resulted in crop stress due to drought in the beginning and or the end of the wet season. It is worthy to note that absence of research on farmers' information, social and psychological needs by information services on the contemporary farming practices to boost food security is deficient in the agricultural sector. This limits the exposure a farmer would have had on adoption of better

improved farming technologies and to some extent culminated into constraining the farmer from adjusting to the current challenges to food security.

2.5 Theoretical framework

This research work would be guided by the theory of social change. Such as Modernization theory

2.5.1. The Social Change

According to Rogers, (1969) social change is defined as the process by which alterations occur in the structure and function of social system. Social system may be a social group, a community, a city, a region or a nation. Any change that occurs either in ideas, norms values roles and social habits of a people or in the composition or organization of their society is referred as social change. Adekoya and Tologbonse, (2005), further buttressed social change can be viewed as a state of dynamism which preludes stagnation and if well managed and directed always implies progress development and functioning of a social system. According to Ekong, (2003), Social change is the modification in human attitudes and behavior pattern as a result of education. Farmers are expected to adopt a more favourable attitude toward a specific innovation as a result of extension services and therefore decide to change their farming system by incorporating those innovations. The change agents in this respect serve as catalyst towards facilitating adoption of these improved technologies to the farmers' cooperatives. The farmers' perception of these innovations would depend on the effective roles of these change agents in the diffusion process.

2.5.2. The Modernizations Perspectives

The concept modernization was commonly invoked in efforts to explain long-term change. Modernization is the process which denotes societal changes in all spheres of human life from less developed to develop ones. It involves imbibing those technological traits that are assumed

better than the existing ones. It also denotes the economic and social change that is brought about by the introduction of industrial mode of production into a pre-industrial society (Robertson, 1983) Modernization theory is a theory used to explain the process of modernization within societies. The theory looks at the internal factors of a country while assuming that, with assistance, "traditional" countries can be brought to development in the same manner more developed countries have. Modernization theory attempts to identify the social variables which contribute to social progress and development of societies, and seeks to explain the process of social evolution. Modernization theory not only stresses the process of change but also the responses to that change. It also looks at internal dynamics while referring to social and cultural structures and the adaptation of new technologies.

Historically, the idea of modernization is relatively new. Its basic principles can be derived from the Idea of Progress, which emerged in the 18th century Age of Enlightenment with the idea that people themselves could develop and change their society. French philosopher Marquis de Condorcet was involved in the origins of the theory with the concept that technological advancements and economical changes can enable changes in moral and cultural values. Condorcet was the first to make the economic-social development connection and that there can be continuous progress and improvement in human affairs. With that said, new advancements and improvements would need to keep pace with a constantly changing world. Furthermore, he encouraged technological processes to help give people further control over their environments, arguing that technological progress would eventually spur social progress. In addition to social structure and the evolution of societies, the French sociologist

Émile Durkheim developed the concept of functionalism which stresses the interdependence of the institutions of a society and their interaction in maintaining cultural and

social unity. His most famous work is The Division of Labour in Society, which described how social order was to be maintained in a society and how primitive societies might make the transition to more economically advanced industrial societies. Durkheim suggested that in a capitalist society, with a complex division of labour, economic regulation would be needed to maintain order. He stressed that the major transition from a primitive social order to a more advanced industrial society could otherwise bring crisis and disorder. Durkheim, furthermore, developed the idea of social evolution, which indicates how societies and cultures develop over time much like a living organism essentially saying that social evolution is like biological evolution with reference to the development of its components. Like organisms, societies progress through several stages generally starting at a simplistic level and then developing into a more complex level. Societies adapt to their surrounding environments, but they interact with other societies which further contribute to their progress and development.

2.5.3 Application of the theory

New technology is a major source of social change. Since modernization deals with social change from agrarian societies to industrial ones, it is important to look at the technological viewpoint. New technologies do not change societies by it own. Rather, it is the *response* to technology that causes change. Take for example in the adoption of improve maize technologies to farmers. This new innovation has brought to farmers better ways of farming involving application of easy strategies that can lead to increase yield such as labour saving device, time savings, energy preservation, costs effectiveness and above all improvement in income, and standard/level of living compared to the traditional method. Technological change is not additive it is ecological. A new technology does not merely add something; it changes everything". People in society are always coming up with new ideas and better ways of making

life easier and more enjoyable. Technology makes it possible for a more innovated society and broad social change. What becomes of this is a dramatic change through the centuries that has evolved socially, industrially, and economically, summed up by the term modernization. Improved agricultural technologies for example, have changed lives of millions of farmers throughout the world.

Most farmers are said to go through logical, problem solving process known as adoption process when considering any new technology or innovation. A farmer's decision about whether or not to adopt a recommended agricultural practice is recognized to occur over a period of time in stages rather than instantaneous (Van den Ben and Hawkins, 1996). In other words, for a successful adoption of any new technology, farmers must not only know about it, but must be able to follow the recommendations given (Garpat, 1996). It is a well known fact that not all farmers adopt technologies at the same rate due to differences in behavior to technologies (Van and Hawkins, 1996).

2.6. Definition of concepts

2.6.1 Technology

Various authors define the term 'technology' in a variety if ways. Rogers, (1995) used the words 'technology' and 'innovation' synonymously and defines technology as the design for instrumental action that reduces the uncertainty in the cause effect relationship involved in achieving a desired outcome. Technology is a set of ideas'. New ideas are associated with some degree of uncertainty and hence a lack of probably on that outcome. For a technology to impact on the economic system, blending into the normal routine of the intended economic system without upsetting the system's state of affairs is required. This entails overcoming the uncertainty associated with the new technologies. It therefore causes no surprise that several

studies set out to establish what these factors are, and how they can be eliminated (if constraints) or promoted (if enhancers) to achieve technology adoption.

A cheaper definition of the term 'technology' can be obtained from the work by Enos and Park (1988), who in their study of adoption of imported technology, define technology as "the general knowledge of information that permits some tasks to be accomplished, some service rendered, or some products manufactured". Abara and Singh (1993) explain that it is the actual application of that knowledge that would be termed 'technology'. Although in the Enos and Park (1988) study, the focus was non-agricultural, this definition fits agricultural technologies too. From their definition, it is clear that technology is aimed at easing work of the entity to which it applies. Most technologies are therefore consequently termed labour saving, time saving, capital saving or energy saving and so forth. To economists this implies saving on resources that are scare.

2.6.2 Adoption

Adoption is an outcome of a decision to accept a given innovation. Feder *et al.,* (1985) while quoting Roger's earlier work of 1962 define adoption as a mental process and individual passes from first hearing about an innovation to final utilization. Much scholarly interest on adoption falls in two categories: rates of adoption, and intensity of adoption. It is usually necessary to distinguish between these two concepts as they often have different policy implications. Rate of adoption, the relative speed with which farmers adopt an innovation has as one of its pillar the element of 'time' on the other hand; intensity of adoption refers to the level of use of a given technology in any time period.

In a clear term, a technology that is being adopted has an edge over conventional practices. Usually, a technological innovation encompasses at least some degree of benefits for its potential adopters (Rogers, 1995). In this study, technology as it relates to maize production is

a set of practices (new or old) integrated into a package that aims to produce high quality yield. According to Cameron, (1999) the dynamics process of adoption involves learning about a technology over time. Infact, many innovations require a lengthy period of many years from the time they become available to the time they are widely adopted. Several stages preceded adoption. Awareness of a need is generally perceived as a first step in adoption process (Rogers, 1983). The other stages are Interest, Evaluation, Acceptance, Trial and finally Adoption (Lionberger, 1960). The Lionberger analysis also notes that these stages occur as a continuous sequence of events, actions and influences that intervene between initial knowledge about an idea, product or practice, and the actual adoption of it.

Adoption is defined as the decision to make full use of an innovation as the best course of action available (Rogers, 1995). For it to occur, certain characteristics of the innovation itself, as well as other factors that are external to the innovation, must exist. Rogers, (1995) presents five primary and four secondary characteristics of an innovation that influence its rate of adoption. The primary characteristics are its relative advantage, compatibility with existing needs, how complex it is, the degree to which it may be experimented on a limited basis (trialability), and the degree to which its results are visible to others (observability). The secondary characteristics are completeness, flexibility, readiness, and replicability. Of specific interest to this study, are the economic relative advantage and the compatibility characteristics.

Feder and Zilberman, (1985) defined adoption as the degree of use of a new technology when a farmer has full information about the technology and its potentials. On the other hand, aggregate adoption is the process by which a new technology spreads or diffuses within the society. A distinction exists between adoption and individual household's levels and aggregate adoption within a targeted society. If an innovation is modified periodically, however, the equilibrium level of adoption will not be achieved. As the new technology is introduced some

farmers will experiment with it before adopting. Farmers are also known to adopt technology packages in steps, beginning with simpler and cheaper technologies. The rate of adoption is defined as the percentage of farmers who have adopted a technology over time. The incidence of adoption is defined as the percentage of farmers using a technology at a specific point in time. The intensity of adoption is defined as the level of adoption of a given technology. For example, the number of hectares planted with improved seed or the amount of fertilizer applied per hectare.

2.6.3 Diffusion

Rogers, (1962) defined the term diffusion as a process by which innovation spreads and the diffusion process is the spread of new ideas from its source of invention or creation to its ultimate users or adopters. An innovation is an idea or method which is regarded as new by an individual or group of people. The diffusion of these innovations can be negative or positive. The after results would usher in a change in the farming pattern of these members of farmers' cooperatives. Ogunbameru, (2001), also stated that diffusion is the spread of a new technology across a population over time. Similarly, it is the process by which a new idea or practice is communicated or transferred from its source of invention or development to the ultimate adopters. Rogers, (1995) stated that the end goal for a change agent is to develop self-renewing behavior on the part of the clients. The change agent should seek to put him or herself out of business by developing the clients' ability to be their own change agents. In other words, the change agent seeks to shift the clients from a position of reliance on the change agent to one of self-reliance. This includes among other responsibilities, that of facilitating the technology adoption process.

2.7. Cost of technology

The decision to adopt is after an investment decision. Caswell et al, (2001) note, this decision presents a shift in farmer's investment options. Therefore can be expected to be dependent on cost of a technology and on whether farmers posses the required resources. Technologies that are capital intensive are only affordable by wealthier farmers (El Oster and Morechart, 1999) and hence the adoption of such technologies is limited to larger farmers who have the wealth (Khanna, 2001). In addition, changes that cost little are adopted more quickly than those requiring long expenditures; hence both extent and rate of adoption may be dependent in the cost of technology. Economic theory suggests that a reduction in price of a good or service can result on more of it being demanded.

2.8. Theoretical Model

A model is a construction that shows relationships existing among variables. These relationships are depicted schematically or mathematically (Asika, 2001). Theoretical model is meant by a broad system of explanation which is founded not so much on prior research findings but largely on untested and unproved assumptions about social realities (Ekong, 2003). The model for this study posits that socio-economic characteristics of farmers, institutional variables are expected to influence the adoption behavior on improved technologies, which lead to increase in yield and income of the farmers.

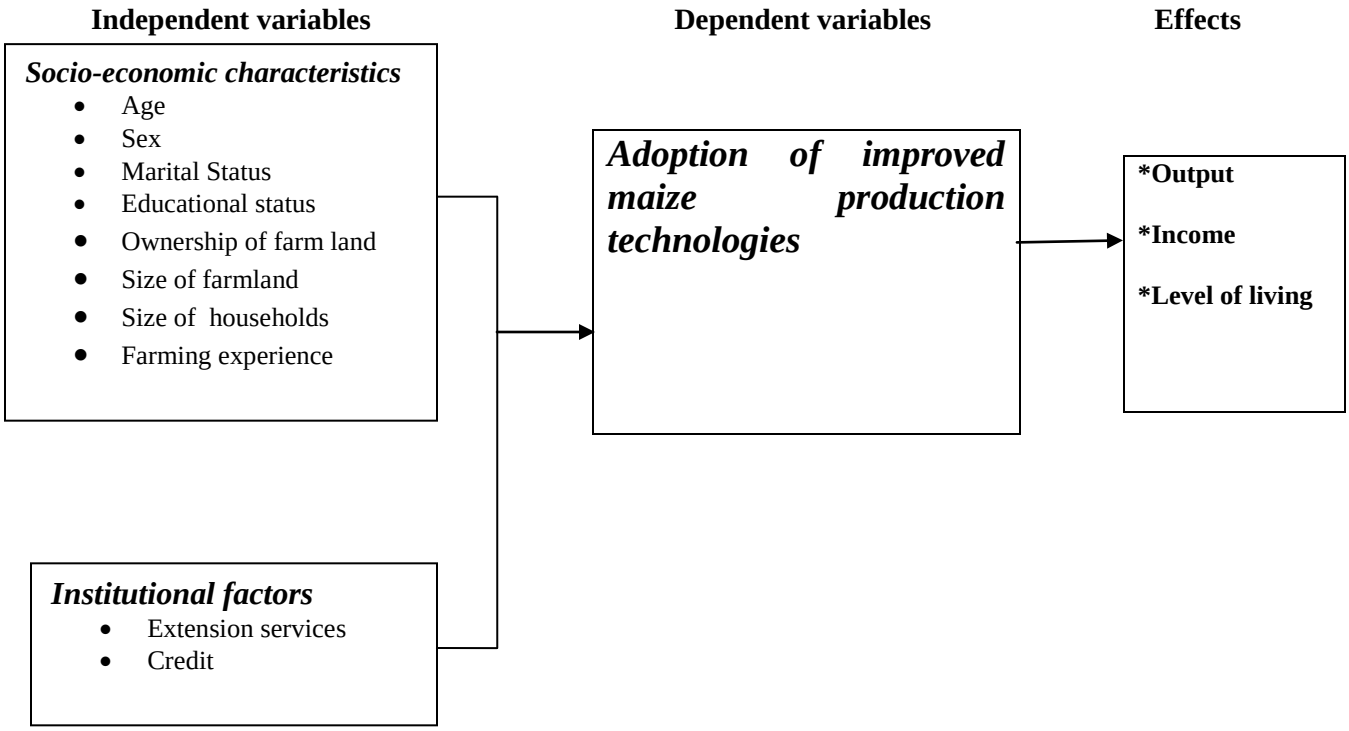

Figure 1: Theoretical model showing the relationship between factors influencing adoption of improved maize technologies among farmers.

The dependent variables to be explained (adoption of improved technologies) is a measure of success or failure of adoption. If the variables presented in the model can explain them, the findings may used to guide planning.

In the model, the socio-economic and institutional variables are seen as the independent variables producing differences towards adoption level.

Chapter Three

3.0 Methodology

3.1 General Description of the Study Area

The research was conducted in Giwa Local Government Area of Kaduna State, Nigeria.. Kaduna State occupies almost the entire central portion of the Northern part of Nigeria, and shares common boundaries with Katsina, Kano to the North, Nassarawa, to the South, Federal Capital, Niger to the West, and Plateau States to the East. The State is located in the northern Guinea savannah of the vegetation zones between latitude 9" and 12N and longitudes 6"E of the prime meridian (Kaduna State Statistical Year Book, 1996).

Giwa Local government is known to have a tropical savannah climate with very short rainy season which is experienced between the months of May through October and long dry season which is experienced between the months of November through April. The soils are mixture of fine sand and clay which has been described as sandy loam in texture. The mean annual temperature varies between 24"C and 27"C (Kaduna State Statistical Year Book, 1996).

The population of Giwa Local Government is 286,427 (NPC, 2006). Giwa Local government has about 11 wards that constitute the local government: namely Giwa central, Yakawada, Gangara, Shika, Panhauya, Danmahawayi, Kankangi, Idasu Galadimawa Kudandan and Kadagi wards.The vegetation of the area is mostly grasses and shrubs. Economic trees are also found in the area such as mangoes and oranges. The major economic activity in the area is agricultural activities. Some of the crops grown in the area include millet, maize, sorghum, groundnut, cowpea, vegetables tomatoes, pepper and sugar cane. Other non-agricultural activities engaged by men include: Blacksmithing, leather work, mat and basket making and trading while women also engage in technical handcraft and trading.

3.2. Sampling procedure and sample size

With the recognizance visits to all the wards in Giwa Local Government, it was possible to identify some farmers who major on maize production. Based on the lists of maize farmers obtained from each of the communities a total number of 631 farmers constituted the sample frame. Out of which 20% of respondents were purposively selected from each wards of the Local Government Area for the study bringing the total number of sample size to 126.

The table below shows:

S/No,	Wards in Giwa Local Govt.	Major Maize farmers in each ward	20% of sample size required
1	***Giwa Central***	72	14
2.	***Gangara:***	69	14
3.	***Shika:***	66	13
4	***Yakawada:***	**75**	15
5	***Panhauya:***	25	5
6	***Danmahawayi:***	51	10
7	***Kadagi:***	76	15
8	***Galadimawa:***	60	12
9	***Kakangi:***	45	9
10	***Kudadan:***	24	5
11	***Idasu:***	68	14
	TOTAL	***631***	***126***

Reason for purposive selection of respondents in these communities or wards was based on minimum of five (5) hectares of farm land a farmer cultivated. This is to determine the farmers' level of seriousness on adoption of these improved maize technologies and not to allow the data generated to be cumbersome if it was based on minimum of one (1) hectare

3.3. Instrument of Data collection

The method of data collection in this work was interview method which involved the administration of structured questionnaire.

Information gathered was basically on the following:

Socio-ecnomic characteristics such as age, sex, farm size, level of education and experience in the adoption of improved maize technologies, and institutional variables.

3.4. Analytical Techniques

Based on this study the following tools of analysis were used to achieve the objectives.

3.4.1. Descriptive Statistics

This involved the use of means, percentage, and frequency distribution to achieve objectives i, ii, iv and v.

3.4.2. Multiple Regression Model

The multiple regression models were used for estimating the contributions of each independent variable to the dependent variable to determine the best variables predictive of adoption and effects of improved maize technologies on farmers in the study area. This was use to achieve objective iii.

$$Y=a+a_1X_1+a_2X_2+a_3X_3+a_4X_4+a_5X_5+a_6X_6+a_7X_7+a_8X_8+a_9X_9+a_{10}X_{10+}U \quad (1)$$

Where: Y=Adoption 1, non adoption otherwise 0)

a=constant

bs=coefficients

Xs=explanatory variables

E=error term

X_1=age,

X_2=sex

X_3=marital status

X_4=educational status

X_5=ownership of farmland

X_6=Size of farmland

X_7=size of households

X_8=farming experience

X_9=extension services

X_{10}=credit

3.5 Operational Definition and Measurement of variables

3.5.1. Independent variables

i. **Age (X_1):** This denotes the actual period a respondent has lived. Age could have an influence on an individual's adoption experience. This was measured by the respondent's number of years from birth reported during data collection. Age is said to be a primary latent characteristics in adoption decisions. However, there is contention on the direction of the effect of age on adoption. Age was found to positively influence adoption of maize and sorghum (Adesina and Baidu-Forson, 1995). Age has also been found to either negatively correlated with adoption or not significant in farmers adoption decisions. Baidu-Forson (1999) in his study on adoption of land conservation practices in Niger, Rice in Guinea by (Adesina and Baidu Forson, 1995), Fertilizer in Malawi (Green and Ngongola 1993), and Hybrid Cocoa in Ghana (Boahener *et al.*, 1999), age was either not significant or was negative to adoption. Older farmers, perhaps because of investing several years in a particular practice, may not want to jeopardize it by trying out a completely new method. In addition, farmers perception that technology development and their subsequent benefits, require a lot of time to realize, can reduce their interest in the technology because farmers' advanced age, and their possibility of not living long

enough to enjoy it (Caswell *et al*., 2001). Furthermore, elderly farmers often have different goals other than income maximization, in which case, they will not be expected to adopt an income enhancing technology (Khanna, 2001). As a matter of fact, it is expected that the older that do not adopt a technology do so at a slow pace because of their tendency to adapt less swiftly to a new phenomenon (Tjorahon, 1995).

Finally, the farmer's age has a direct bearing on his or her approach, open or conservation and levels of exposure to new technologies. Age has a bearing as some agricultural technologies need physical labour input. The farmer's age can increase or decrease the probability of adopting improved maize technologies.

ii. **Gender (X_2):** This signifies the character of being male or female. This was measured by respondents indicating whether they are male (1) or female (0).

iii. **Marital status (X_3):** This is the character which signifies whether the respondent is single (1) or married (0).

iv. **Level of Education (X_4):** This refers to the number of years a respondent spent in formal education. This was measured in terms of, no formal education (0), primary education (1), secondary education (2) and tertiary education (3), Qur'anic school (4) given by the respondents as at the period of data collection. Studies that have sought to establish the effects of education on adoption in most cases relate it to years of formal schooling (Tjornham 1995, Feder and Slades, 1984). Generally education is thought to create a favourable mental attitude for the acceptance of new practices especially on information intensive and management intensive practices. Rogers, (1983) indicated that technology complexity has a negative effect on adoption. Education is thought to reduce the amount of complexity perceived in a technology thereby increasing adoption rate

The ability to read and understand information that may be contained in a technological package is an important aspect of adoption. Furthermore, distribution of knowledge reduces the risk of adopting a new technology; increased education is thus expected to improve maize technologies adoption.

v. **Ownership of farmland (X_6)**: This is the character which signifies the acquisition of farmland through hereditary, transfer or rented.

vi. **Size of households (X_7)**: This was measured by the total number of persons consisting of parents, children, relatives and dependents who share same residential accommodation and responsibility for production within the household. However, household head's occupation has a corresponding implication on his or her income and on the amount of time spent on farm activities. A household head who is permanently employed has an assured income and is therefore more likely to high labour and adopt recommended maize technologies.

vii. **Size of farmland (X_8)**: This was measured by the total area of farm land in hectares the farmer owned and cultivates. The unit of measurement: 1 (one) for 1-5hactares, 2 (two) for 6-10hactares, 3 (three) for 11-15hactares and 4 (four) for 16-20hactares. Small farms have a greater likelihood of adopting improved maize technologies as they are more intensively managed. The area under maize cultivation or quantity of maize grown has a positive relationship with income levels. Farms with a larger area under maize earn more income and this increases the probability of adopting maize improved technologies. Similarly, the use of hired labour increases opportunities to undertake other farm activities; the ability to hire labour is also an indication of wealth and hence increases probability of adoption. The purpose for which maize is grown subsistence or the market influences maize technologies adoption. A

commercially oriented farmer would be more interested in high yield and is more likely to adopt improved maize technologies to boost production. A large area under maize cultivation is considered to increase a farmer's interest new technologies.

Farm size affects adoption costs risk perception, human capital, credit constraints, labour requirements, tenure arrangements and moreover, with small farms, it has been argued that large fixed costs becoming constraints to technology adoption. (Abara and Singh, 1993) especially it the technology requires a substantial amount of initial set up cost. Feder *et al.*, (1985) further noted that only larger farms will adopt those innovations with some technologies, the speed of adoption is different from small and large scale farmers. A counter argument on the effect of farm size can be found in Yaron *et al.*, (1992) who demonstrated that a small area may provide an incentive to adopt a technology especially in the case of an input intensive innovation such as a labour intensive or land saving technology. In the study, the availability of land for agricultural production was low, consequently, most agricultural farms were small. Hence, adoption of land saving technologies seemed to be the only alternative to increase agricultural production. Further, in the study by Fernandez, (1996), farm size did not positively influence adoption.

viii. **Farming experience**: This is the character of measuring the actual number of years the farmer has engaged in farming activities.

ix. **Extension services (X_{10}):** This is the number of contacts the respondents had with the extension workers. This was measured based on the number of visits a respondent reports to have had with the extension officer. This was on: yearly (1), quarterly (2), monthly (3), weekly (4). Good extension programmes and contacts with farmers are a key aspect in technology dissemination and adoption. A recent publication stated that

"a new technology is only as good as the mechanism of its dissemination" to farmers (IFPRI, 1995). Most studies analyzing technology show its strong positive influence on adoption. Infact, Yaron *et al*, (1992). Show that its influence can counter balance the negative effect of lack of formal education in the overall decision to adopt some technologies. Extension services are a major source of technical information for farmers. It is therefore, to note that extension contacts or proximity to extension increases adoption. Farmers participate on farmer training and retraining courses and listen regularly to agricultural programmes on the radio are assured to be more likely adopters.

x. **Access to credit (X_9):** This refers to the loan received either in cash or kind from institutional or non-institutional organizations for agricultural purposes. This denotes whether credit facilities have an influence on the respondent's attitude to acceptance or rejection of the improved maize technologies which is considered less laborious. Farmers who have access to credit have more options to acquire often costly new technologies such as improved seed, fertilizer and lot more. Access to funds (through a bank loan) is expected to increase the probability of adoption yet to be eligible for a loan, the size of operation of the borrower is crucial. Farmers operating large farms land to have greater financial resources and chances of receiving credits are high than those of smaller farms.

3.5.3 Dependent variable

The dependent variable is the adoption of improved maize technologies by each respondent and effects of using the improved technologies.

i. **(a). Adoption of the improved maize technology:** Adoption in this context refers to the continuous use of an innovation or new idea. The level of adoption of these improved maize technologies was measured by determining respondents most

adopted packages of these technologies. This refers to the acceptance and application of the new and better technologies. These includes: (i). Improved seeds, (ii). Seed dressing, (iii). Appropriate quantity of organic and inorganic fertilizer, (iv). Appropriate planting spacing, (v). Appropriate method of fertilizer application and (vi). Appropriate method of pest and disease control. The adoption of these improved maize technologies by farmers referred to the use of these technologies on a continuous basis. In this case, these variables were studied and scored based on respondents' response. (Yes) was score 'one' and zero to (No) as to whether the technologies were adopted or not as at the time of the study. Based on this, adoption was measured in terms of the number of farmers who adopt the technology package in the study area.

b). Effects of adoption of the improved technologies

The effects of these improved maize technologies on farmers were measured in terms of total yield, income and level of living. People do not participate unless they believe it is in their best interest to do so. Farmers must see an advantage or expect to obtain greater utility in adopting a technology. In addition, farmers must perceive that there is a problem that warrants an alternative action to be taken without a significant differences in outcome between two options, and in the returns from alternative and conventional practices, it is less likely that farmers, especially small scale farmers will adopt the new practices (Abara and Singh, 1993). Farmers may receive little long term benefits of improved technology adoption with negatively influencing adoption. A higher percentage of total households income coming from farm through increased yield tends to correlate positively with adoption of new technologies (McNamara *et al*. 1991; Fernandez, 1996)

ii. **Yield**: This is the total maize production based on the number of (ha) of land a respondent cultivated at the farming season.

iii. **Income:** This is the total income in (₦) generated by the adoption of these technologies by farmers. This was measured in Naira (N) per bag/kg.

iv. **Level of living:** This denotes the level of living generally used to describe the quantity of goods and services actually consumed by an individual and his/her family members (Ekong, 2003). This includes the ownership and use of such items as radio, television, refrigerator, eating of balance regular meals, being well clothed, living in a decent house and surrounding. This was measured by scoring yes (1) and No (0).

Chapter Four

4.0 Results and Discussion

This chapter discusses and presents the findings of the research work.

4.1. Socio-economic characteristics of respondents.

Data in Table 4.1 shows that 34% of the respondents with a mean of 38years were between the ages of 36-45years. This is an advantage for increased adoption of improved technology utlilization by these virile individuals who still have the strength and zeal to participate in farming for food sustenance. Results further showed that those between the ages of 46years and above were 29%, owing to the reason that these old farmers are predominantly subsistent farmers and engage in farming as an occupation. Followed by those between the ages 26-35years had 27%. These groups of farmers would have been expected to be the most virile farmers as these ages consist of youthful individuals. The low percentage of these groups of ages could be as a result of migration to urban cities to search for menial/casual labour or engage in motor-cycle riding business. Finally, table 4.1 shows that those between the ages of 15-25years were 19%. This implies that most of these respondents are of school ages and would be considered engaging in farming for part-time activities. Similarly table 4.1 reported that 39% of the respondents had Quor'anic education. While table 4.1 stated that 23% of the respondents had secondary education while primary education and tertiary education had 20% and 19% respectively. Finally, no respondents signified not having forma education.

(Obinne, 1991) stated that low level of education among the respondents would likely make them more irresponsive to many agricultural policies. As education is an advantage to adoption of farm innovations as it enhances better awareness, understanding, enlightenment and behavioral change. Table 4.1 also stated that majority 83% of respondents were male while 17% of respondents were female. This low involvement of women in farming activities have a

number preconditions in the study area ranging from cultural, religious and traditional beliefs, which inversely hinder women to public participation to activities that would expose the women to their men folks. Angwu and Anyanwu (1996), reported that increased in education of farmers positively influences adoption of improved practices.

Table 4.1 revealed that 35% of the respondents cultivated between 6-10 hectares of farmland while 33% of the respondents cultivated between 0.5 hectares of farmland. Table 4.1.reported that 19% of the respondents cultivated 11-15 hectares of farmland, with the lowest 13% cultivated 16 and above hectares of farmland. This implies that the study area comprises of small scale farmers. This agrees with the work of Olajide (1992), that Nigeria farmers are small scale farmers that cultivated small farm areas of land. The relatively small farm size of the respondent will inevitably lead to subsistence farming which does not encourage commercial farming. In a contrary view, even as the respondents cultivated enormous hectares with little output which cannot be quantify, still alerts that constraints to effective farming still permeates. Table 4.1 indicates that those respondents' households between 6-10 members constituted 29%, while the table 4.1 showed that households between 0-5 members constituted 26%. This implies that family labour supply for agricultural activities is inadequately unavailable as these households would consist of few members with low productive input as much labour supply would be employed.

Table 4.1 further stated that respondent's households between 11-15 members and 16 and above constituted 20% and 25% respectively. The implication of this finding is that more family labour supply would be readily available since relatively large household size is an obvious advantage in terms of farm labour supply. Respondents had between 21years of farming experience which constituted 38%. Table 4.1 further stated that respondents had between 11-15 years, 1-5 years, 15-20years and 6-10 years of farming experience which constituted 20%, 16%,

14% and 13% respectively. Long farming experience is an advantage for increase in farm productivity since it encourages rapid adoption of farm innovation.

Table 4.1 Distribution of respondents according to their socio-economic characteristics

Variables	Frequency	Percentage
Age (Years)		
15-25	12	10
26-35	34	27
36-45	43	34
>45	37	29
Gender		
Female	22	17
Male	104	83
Educational level		
No formal education	0	0
Primary school	25	20
Secondary school	29	23
Tertiary school (Dip./NCE)	24	19
Qur'anic school	48	39
Size of farmland		
0-5hectares	42	33
6-10hectares	45	35
11-15hectars	24	19
16-above	16	13
Size of households		
0-5	33	26
6-10	37	29
11-15	25	20
16-above	32	25
Farming experience (yrs)		
1-5	20	16
6-10	16	13
11-15	25	20
16-20	18	14
21-above	48	38
Total	**126**	**100**

Table 4.1.2 shows respondents 24% consisting of both quarterly and yearly had their extension visits to their farms. While those who had their extension visits on monthly, weekly and daily constitute 21%, 12% and 19% respectively. From the foregoing analysis, it can be

concluded that as a result of accessibility of extension agents, the respondents were receiving as many extension visits support as necessary. This appears to indicate that the extension agents are playing their roles in promoting agricultural innovation in the study area.

Table 4.1.2. Distribution of respondents according to Extension visits

Variables	Frequency	Percentage
Extension visits		
Daily	24	19
Weekly	15	12
Monthly	26	21
Quarterly	31	24
Yearly	30	24
Total	**126**	**100**

Table 4.1.3, indicates that majority, 61% of the respondents had agricultural credits through their personal savings. The table further stated that 42% also had their credit through banks. Similarly, 40% consists of those who had their agricultural credit through the cooperatives they belong to. The table 3 further shows that Contributions, Friends and relatives constitute 20% and 20% respectively. From this indicator, it denotes that respondents generate their income for purchase of farm input, leasing of land and labour from their personal savings. This personal savings would however not make much difference from exiting from food subsistence to commercial farming.

Table 4.1.3: Distribution of respondents according to their sources of credit

Variables	Frequency	Percentage
Sources of credit		
Banks	53	42
Cooperatives	51	40
Contributions	25	20
Friends and relatives	25	20
Personal savings	78	61
Total	**126**	**100**

Table 4.1.4 revealed that 43% of the respondents signified that the technologies were good. The Table also stated that 39% rated the technologies as being fair. While 15% and 2% considered the technologies as excellent and poor respectively. From the aforementioned indicators, it simply expresses that the technologies are becoming adaptable to the rural farmers' who may have been used to local method of farming.

Table 4.1.4. Distribution of respondents according to their rating quality from improved maize technologies on farm production

Rating quality	Frequency	Percentage	Ranking
Good	55	43	1st
Fair	50	39	2nr
Excellent	18	15	3rd
Poor	3	2	4th
Total	**126**	**100**	

Table 4.1.5 indicates that 62% of the respondents had increased yield. It also revealed that 52% of the respondents had increased farming skills while 44% had increased produce quality. This Table expresses that the respondents performed above average in the adoption of these improved technologies.

4.1.5. Distribution of respondents according to their benefits derived from the use of improved maize technologies on farm production.

Benefits	Frequency	Percentage
Increased yield	79	62
Increased farming skills	66	52
Increased produce quality	44	44
Total	**126**	**100**

4.2. Sources of information to farmers on improved maize technology package

Table 4.2.1 reveals that the ADPs and Cooperatives as sources of agricultural information to farmers constitute 87% and 87% respectively, ranking 1st and 2nd. The table 4.2.1 further indicates that radio constitutes 69%, Extension officers 66%, agricultural show/field day 48%, Television 45%. Others include Newspaper21%, Fellow farmers 20%, Research institutes 14%, friends and relatives 12%. Based on the table indicators, it is worthy to note that ranking from numbers 1 to 6 are the best modern method of generating agricultural information by farmers. These methods are easily accessible to farmers in their localities. It may not require the farmers journeying for a distance to acquire relevant agricultural information which may hamper the enthusiasm of adoption. The findings are in relation to the works of Aboyade, (1987); and Ozowa, (1995) who stated that wide range of agricultural information sources are available to farmers. Venkatesan (1995) also posited that the mass media like radio is particularly effective in making farmers aware of new improved technologies irrespective of distances or barriers.

Rogers, (1964) observed that wide availability of mass media (television, radio and magazines) is often limited by cost and literacy. He noted that localized sources of information, such as neighbours and friends, could play a greater role in the diffusion of technology than formal extension services. Acquisition of information about a new technology demystifies it and makes

it more available to farmers. Information reduces the uncertainty about a technology's performance hence may change individuals assessment from purely subjective to objective over time (Caswell *et al*, 2001). Exposure to information about new technologies as such significantly affects farmer's chances about it. Feder and Slade, (1984) indicate how, provided a technology is profitable, increased information induces its adoption. However in the case where experience with the general population about a specific is limited, more information induces negative attitudes towards its adoption, probably because more information exposes an over bigger information vacuum hence increasing the risk associated with it.

Table 4.2.1. Distribution of respondents' according to their sources of agricultural information

Sources of information	Frequency	percentage	Rank
Cooperatives	111	87	1st
Organizations (ADPs)	110	87	2nd
Radio	87	69	3rd
Extension officers	84	66	4th
Agricultural show/field day	61	48	5th
Television	57	45	6th
Newspapers	26	21	7th
Fellow farmers	25	20	8th
Extension bulletin	18	14	9th
Research institute	18	14	9th
Friends/relatives	15	12	10th
Total			

4.3. Factors influencing the adoption of the improved maize technologies by farmers

The table 4.3.1 reveals that all (100%) of the respondents stated that they were aware of improved seeds and seed dressing. The table further illustrated that 98% of the respondents are aware of appropriate pest/disease control while 94% of the respondents are aware of appropriate quantity of inorganic and organic fertilizer. Others include 97% of the respondents are aware of appropriate planting spacing and 91% of the respondents are aware of appropriate fertilizer application. Based on the table figures, it implies that there was high level of awareness of this improved package. This means that if farmers adequately adopt these improved technologies with much enthusiasm and complete adherence to these technologies, farmers would have massive food production which would enhance food security in the study area and Nigeria at large.

Table 4.3.1. Distribution of respondents according to their level of awareness on the improved maize technologies

Awareness	Frequency	Percentage
Improved maize technologies		
Improved seeds	126	100
Seed dressing	126	100
Appropriate pest/disease control	125	98
Appropriate quantity of inorganic organic fertilizer	120	94
Appropriate planting spacing	123	97
Appropriate fertilizer application	116	91
Total		

The 4.3.2 illustrates that 80% of respondents adopted improved seeds in 2009/2010 and 100% of the respondents adopted also improved seeds 2010/2011. This shows an increase of 20%. The table states that 81% of the respondents adopted Seed dressing in 2009/2010, while 93% of the respondents adopted seed dressing in 2010/2011 farming season. Similarly, 21% of

the respondents also adopted appropriate pest/disease control in 2009/2010 while 10% of respondents adopted appropriate pest/disease control in 2010/2011. This signifies the ability to understand better techniques of the technological packages. The table further illustrates that 39%, 67% and 59% of respondents adopted appropriate quantity of inorganic and organic fertilizer, appropriate planting spacing and appropriate fertilizer application in 2009/2010 while 64%, 63% and 86% of the respondents adopted appropriate quantity of inorganic and organic fertilizer, appropriate planting spacing and appropriate fertilizer application in 2010/2011. This table reveals that the high level of adoption in 2010/2011 denotes that the quest for food production in the study area and Nigeria in general is on course coupled with the support the government and agricultural development programs calling for economic diversification into agriculture.

Table 4.3.2. Distribution of respondents according to 2009/2010 and 2010/2011 adoption of improved maize technologies. ***(Adopted and currently using)***

Adopted and Currently using	**2009/2010**		**2010/2011**	
	Frequency	**Percentage**	**Frequency**	**percentage**
Improved maize technologies				
Improved seeds	101	80	126	100
Seed dressing	103	81	118	93
Appropriate pest/disease control	21	17	13	10
Appropriate quantity of inorganic and organic fertilizer	49	39	81	64
Appropriate planting spacing	85	67	80	63
Appropriate fertilizer application	75	59	109	86
Total				

4.3.3. Regression Analysis

4.3.4 The result of the regression analysis in Table 4.3 revealed the factors that are influencing the adoption of maize technologies in the study area. The R^2 value was 0.49; this implies that

49% variation in the adoption of improved maize was due to the independent variables considered in the model. The result showed that four variables were found to be significant in relation to the adoption of improved maize technologies. These variables include education, farm size, household size and gender of the respondents.

The coefficient of educational status was found positive and significant at 5%. The positive coefficient of educational status means that there is a direct relationship between adoption of improved maize technologies and educational status, whereby as educational status increases, adoption level also increases among farmers. Njoku, (1991) in his study on factors influencing adoption of improved oil palm production technologies by small scale farmers in Imo state Nigeria noted that the more educated a farmer the more the chances that he/she will utilize available opportunity and adopt innovation than uneducated ones. It is expected that the higher the educational level the higher the level of adoption and generally, the low level of education of the farmers is inimical to the adoption of innovation, especially one that is complex.

The coefficient of farm size was positive and significant at 5% level. The positive coefficient implies a direct relationship that as farm size increases, adoption of improved maize increases and vice-versa. In order words, the larger the farm size, the higher the potential of adoption. This confirms that large farmers, in comparison to small farmers, adopt improved technologies at a faster rate. Small farm size is an impediment to agricultural mechanization because it will be difficult to use mechanized farming system on small and fragmented individual farms. Small farmers live at subsistence level which may discourage them from adopting improved technologies probably because of financial limitation. Also availability of improved technologies on the other hand would attract the large farmers with the intention of raising their level of income which may give them the opportunities to increase their capital base.

Household size and gender of the household was also found significant with the adoption of improved maize technologies. Family size coefficient was positive and significant at 10% level of significance. This suggests that the respondents with large household size adopt improve maize technologies compared to those with low household size. Households with larger size tend to attract greater importance to food security than those that are small in size. (Odoemenem and Obinne, 2010) reported that large households enable the farmers to concentrate more on farming operation and attracts them to adopt improved technologies which give better yields, earn more income and thereby helping in raising their standard of living.

Age, extension contact and access to credit were not significantly related to the adoption of improve maize technologies among the farmers, however the coefficient of age was negative which implies an inverse relationship with the adoption of improve maize technologies. The importance of age lies in its effect on the adoption of innovations and the processing of information. It is well known that, in general, the older the farmers the less their willingness to try new innovations or take risks. In the process of growing old, individual undergo social, psychological and physical changes. These changes results in the reduction of involvement with others and decline in physical energy (Phillips and Sternthal, 1977; Fabyan (1999). As a result, a substantial portion of their interpersonal contacts are with members of their extended families and friends (Odoemenem and Obinne, 2010).

Table 4.3.4 Regression results of some selected variables of socio-economic and institutional factors influencing the adoption of improved maize technologies among farmers in the study area.

Variables	Coefficient	Standard Error	T-value
Constant	5.381	0.885	6.080***
Age	-0.0012	0.0825	-0.0155
Education	0.115	0.050	0.0478**
Farm size	0.0735	0.0353	2.0805**
Household size	0.1194	0.0668	1.7866*
Farming experience	-0.010	0.0577	-0.176
Extension contact	0.0129	0.0507	0.2549
Credit	-0.6675	0.5628	-1.1860
Gender	-0.2358	0.1373	-1.7170*

$R^2 = 0.49$
*** Sig at 1%
** Sig at 5%
* Sig at 10%

4.4. Effect of adoption on farmers' yield, income and level of living

The table 4.4.1 indicates that majority 50% of respondents cultivated between 30-80 bags of maize. The table 4.4.1 further reveals that 23% of respondents cultivated between 81-130 bags. Others include 8% cultivated between131-180, 4% of each cultivated between 231-280bags and 381-430 respectively. While 8% of each cultivated between 281-330 bags, 331-380, 431-480 and 481-530 respectively. This table 4.4.1 expresses that food insecurity is at alarming rate. Going by the aforementioned indicator, farm activities in the study area is subsistence as majority of the respondents were able to produce between 30-80 bags.

Table 4.4.1 Distribution of respondents' according to output of bags of maize obtained in 2009/2010 farming season.

Bags of maize	Frequency	Percentage	Rank
30-80	63	50	1st
81-130	30	24	2nd
131-180	10	8	3rd
181-230	9	7	4th
231-280	5	4	4th
281-330	1	8	3rd
331-380	1	8	3rd
381-430	5	4	4th
431-480	1	8	3rd
481-530	1	8	3rd
Total	126	100	

4.4.2. Effect of adoption on income

Table 4.4.2 shows that majority 74% of respondents who had 30-130 bags of maize sold and made between N100, 000-N500, 000. The table 4.4.1 further stated that 17% of respondents who also had between 131-280bags sold and made between N501,000-N1,000,000. Others include 7% of 281-430bags on income of N1,001,000-N1,501,000 and 2% of 431-530bags also on income of N1,501-N2,000,000. From the table 4.4.1 indicators, 74% of respondents in the study area represent low level of income generation farmers considering the number of hectares cultivated. This is owing to the reason that there was no total commitment and adherence to the adoption of these improved maize technologies.

Table 4.4.2. Distribution of respondents' according to income on sale of maize (bags N) during 2009/2010 farming season

bags	Income	Frequency	Percentage
30-130 bags -	N100,000-N500,000	93	74
131-280bags -	N501,000-N1,000,000	22	17
281-430bags -	N1, 001,000-N1, 500,000	9	7
431-530bags -	N1,501,000-N2,000,000	2	2
Total		**126**	**100**

4.4.3 Effect of adoption on level of living

The figures in table 4.4.3 reveal that 98% and 97% of the respondents stated that they have additional savings and storage of farm produce respectively. The table also shows that 59% of respondents were able to renovate their houses. The figures in table 4.4.3further stated that 37% of respondents bought motor-cycle, while 38% or respondents bought water facilities. 34% of respondents were able to acquire irrigation pumps. Others include 31% for acquisition of land, 30% of each for motor car, and television, DVD, VCD respectively. The table 4.4.3 illustrated that 32% of respondents had additional wives. From these indicators, it implies that the most pressing needs of respondents were additional savings which would enhance further engagement in farm work when the next season comes and much money to spend for exchange for what the respondent's immediate needs may be. It also implies that storage of farm produce insures food security for the respondent's immediate family in times of scarcity.

Table 4.4.3. Distribution of respondents according to effect on level of living on household own and their current values

Households own	Current value	Frequency	Percentage
Motor car	N100,000-N400,000	38	30
Motor cycle	N10,000-N90,000	47	37
Renovation of house	N20,000-N170,000	74	59
Storage of water facilities	N40,000-N190,000	48	38
Television, DVD and VCD	N30,000-N120,000	38	30
Additional wife	N20,000-N80,000	41	32
Additional savings	N50,000-N400,000	124	98
Acquisition of farm land	N80,000-N160,000	39	31
Storage of farm produce	N20,000-N320,000	123	97
Acquisition of irrigation pump	N30,000-N150,000	43	34
Total			

Table 4.4.4 shows that majority 87% of respondents stated to have output during the harvesting. The table 4.4.4 further shows that 75% had income as a result of the sales of maize produced. The table 4.4.4 also reveals that 52% of respondents indicated to have had change in their level of living. This implies that the money generated would be used to provide necessary socio-economic needs of the family, and probably have some food storage and savings for future funding of farm activities.

Table 4.4.4. Distribution of respondents according to the effect of improved maize technologies on livelihood.

Effect	Frequent	Percentage
Output	110	87
Income	95	75
Level of living	66	52
Total	**126**	**100**

4.5. Constraints encountered on adoption of improved maize production technologies.

The results in table 4.5.1 reveals that majority71% of respondents stated that there was lack of good communication network. In addition 49% and 49% of respondents said there was lack of credit and bad road network respectively. Similar, 66% of the respondents stated to have had difficulty to access to input. This implies that major input like inorganic fertilizer was difficult to obtain. The farmers claim to have had difficulty in obtaining inorganic fertilizer, as they would have to travel as long as 20-30kms to purchase it. Other constraints include, 37%, and 40%, of respondents stated that there was lack of extension officer's attention and high interest rate.

Table 4.5.1. Distribution of respondents according to constraints encountered on adoption of improved maize technologies.

Constraints	Frequency	Percentage
Lack of credit	62	49
Bad road network	62	49
Lack of extension officer's attention	47	37
Lack of good communication network	90	71
Difficulty to access to input	84	66
High interest rate	51	40
No collateral to guarantee credit	69	54
Total		

Chapter Five

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

In this work, the broad objective was to identity factors influencing adoption of improved maize technologies in Giwa Local Government Area, Kaduna state. It is on this note that analysis was carried on socio-economic and institutional factors influencing the adoption of improved maize technologies and level of adoption of improved maize technologies. The result showed that four socio-economic variables were found to be significant in relation to the adoption of improved maize technologies. These variables include education, farm size, household size and gender of the respondents. Age, extension contact and access to credit were not significantly related to the adoption of improve maize technologies among the farmers, however the coefficient of age was negative which implies an inverse relationship with the adoption of improve maize technologies. The study further reveals that majority 74% of the respondents had between 30bags-130bags while 2% had between 431bags-530bags. This implies that food security is at stake since majority of respondents cultivated what can be said to be subsistent farming. It further reveals that level of awareness was high likewise adoption level was also high but most of the farmers gave different reason while they had low out. The reasons were that the improved farm practices needed full attention of the farmer and strict adherence.

There is low positive effect between adoption of improved maize technologies and farmers' output, income and living standards.

5.2 Conclusions

These conclusions were drawn from the research findings.

1. The study showed that majority 31% of respondents had Qur'anic (formal) education. This makes it inimical in facilitating diffusion and adoption process as there is bias and religious beliefs towards modern methods of farming.
2. The study revealed that majority (61%) of respondents had their credit from personal savings. It is obvious to note that the farmers' adoption of these improved packages is limited as their personal savings would not go too far to enhance adequate and full adoption for food security and enable change from subsistence involving manual method of farming to mechanized method.
3. Findings show that ADPs and Cooperatives were sources used by farmers to receive agricultural information. The study also revealed that extension visits were available to farmers as at when due and requested. The information sources of the cooperatives are significant to farmers' knowledge about an improved farm practices. Owing to the reason that technology facilitators or initiators may not have direct contact with the individual farmers, but could convey agricultural information through cooperatives administration which would later transmit the information to the other farmers.

5.3 Recommendations

1. The study revealed low output by majority of respondents resulting from incomprehensive diffusion and adoption process. To ensure food security in the study area there should be some level of capacity building. This has to do with intensive training and retraining on better ways of adopting the improved technologies to these farmers who are mainly subsistence farmers and even to the extension agents who are closer to the rural farmers. Having known the importance of extension agents in creating

awareness on improved farm practices, they should be more robust and pro-active in performing their duties. Extension agents should jettison familiarity in the discharge of their duties for this creates biases and limits knowledge transfer.

2. Based on the overview of the study it is very clear to note that farmers were far away from the labourers who do the main farms work. This has given rise to ineffective and low labour output. The farmer should play a leading and supervisory role in the farm work if he must expect better yield.
3. The regression showed that credit was not significant implying that farmers had no adequate financial support/capacity to enable them adopt comprehensively. Banks should remove the preconditions attached to getting agricultural bank credit to enable farmers under registered entity to collect credit to enhance farm works. The study also revealed that 42% of respondents had access to banks credit. It is obvious to note from the study, the credit obtained was not immensely utilized for the farm purpose it was granted. Therefore farmers should channel any credit given to them to the purpose it was granted to them and not rechanneling it for any other purpose(s) thereby putting expected farm output in jeopardy.
4. From all indications (large portion of hectares of farm land cultivated, large quantities of organic and inorganic fertilizer, huge sums of funds invested to farm activities, time and high cost of labour), it is disheartening to note that striga is the major course for food insecurity in the study area and Nigeria at large. This calls for urgent attention if food security must be achieved before 2020. Striga (*hermonthica and S. asiatica*) are parasites that attacks growing maize roots beneath the ground and siphons off nutrients that would normally feed the plant. This affirmation is realistic based on the constant visit made by the researcher who observed that at week 2-3 of the maize planting season even at the

peak of rain the leaves were not absolute green but partial yellow colour. This observation agrees with the study of Parker and Riches, (1993) as quoted by CIMMTY (2000) that striga also exert a potent phytotoxic effect on its host that results to severe damage on the crops. The study thereby recommends pre-and post emergence herbicides for striga control measure. On this note, the relevant agencies such as ADPs, NGOs the government and host of others should subsidized and make herbicides available and affordable so that these poor rural farmers can take striga control measures before any farming season.

5.4 Contributions of this study to knowledge and further areas of research

1. The study was able to identify some selected variables such as education, farm size, household size and gender of the respondents that were significant to farmer's adoption of improved maize technologies. There is also room for other researchers to carry out studies on other variables to see how significant they will be to the adoption of improved maize technologies.

2. This research work has been able to identify areas of lapses that can be ameliorated by technology transfer initiators that are the ADPs, Extension Agents and Research Institutes. These lapses include application of Peoples Participation Programme (PPP) in practical term. In the contemporary mono-economic society, what the farmer wants in a strong term is enhanced method of farming that could bring or give him the ability to provide food for his family without depending on government. It is on these bases that the farmers need to participate in the experimental programmes that would expose them and give them better knowledge on the new improved farm practices. By so doing they would come back to the drawing board to apply in confidence what was thought to them. It is most obvious to note that transfers of improved farm practices in the study area are done through seminars, conferences, symposiums and lots more.

As long as these methods persist, the issue of food security by year 2020 would be a mirage because these do not have direct bearing on the rural farmers who most likely are illiterates.

3. This study was able to identify lack of homogeneity as a prime factor that hinders bumper maize harvest in the study area. The researcher observed that the needs, priorities and preferences of the farmers are diverse which make the farmer lose concentration and total commitment. Its consequence is the attempt to engage in all the agricultural activities without direct focus which in reverse case leads to downfall of promising agricultural output in the study area.

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Appendix

QUESTIONNAIRES ON FACTORS INFLUENCING ADOPTION OF IMPROVED MAIZE TECHNOLOGIES AMONG FARMERS: A CASE OF GIWA LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

The questionnaire is designed to solicit for your response on factors influencing adoption of improved maize technologies among farmers in Giwa Local Government of Kaduna State of Nigeria. Your responses will be used for academic purposes only and are highly appreciated.

A. SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS:.

1. Age:

a). 15-25 ----------
b). 26-35 ----------
c). 36-45 ----------
d). 46-ABOVE ----------

2. Gender:

a). Male ----------
b). Female ----------

3. Marital Status:

a). Married ----------
b). Single ----------
c). Divorce ----------

4. Educational Status:

a). No forma education ----------
b). Primary School ----------
c). Secondary School ----------
d). Tertiary School (Dip./NCE) ----------
e). Qur'anic School ----------

5. Occupation:

a). Farmer ----------
b). Civil Servant ----------
c). Trader ----------
d). Driver

6. Ownership of farmland:

How do own farmland?

a). Hereditary ----------
b). Transfer ----------
c). Rented ----------

7. Size of farmland:

How many hectares of farmland do you cultivate?

a). 0-5 Hectares ----------
b). 6-10 Hectares ----------
c). 11-15 Hectares ----------
d). 16 and Above ----------

8. Size of households:

a). 0-5 ----------
b). 6-10 ----------
c). 11-15 ----------
d). 16-above ----------

9. Farming experience (yrs):

a). 1-5 ----------
b). 5-10 ----------
c). 11-15 ----------
d). 16-20 ----------
e). 20-above ----------

10. How frequent does the Extension Officer(s) visit(s) the farm?

a). Daily ----------
b). Weekly ----------
c). Monthly ----------
d). Quarterly ----------
e). Yearly ----------

11. Do you receive any form of credit for your farming operation?

a). Yes ----------
b). no ----------

12. If yes, what is your source of credit?

a). Banks ----------
b). Contributions ----------
c). Friends/relatives ----------
d). Personal savings ----------
e). Cooperatives ----------

B. General Background

13. List the maize improved technologies you have adopted and are currently using

a). ----------
b). ----------
c). ----------
d). ----------
e). ----------

14. Rate the quality of these technologies on your farm production.
    a). Excellent
    b). Good
    c). Fair
    d). Poor
15. What are the benefits you derived from the use of these technologies in your farm production?
    a). Increased yield
    b). Increased farming skills
    c). Increased produce quality

16. Do you think these technologies adopted are better than the previous technology?
    a) If yes, state reason(s)----------

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    b) If no, sate reason(s)----------

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17. How many Kg of maize did you produce during the 2009/2010 farming season as a result of the adoption of these technologies?
    a. ----------
18. Did you sell maize that year?
    a). Yes
    b). No
19. How much did you obtained from the sales of maize during the year 2009/2010?
    a). ----------

20. How much of the following does your household own that are usable and what are their current value?
    b). Motor/motor-cycle ----------
    c). Renovation of your house ----------
    d). Storage of water facilities ----------
    e). Television, DVD and VCD. ----------
    f). Additional wives ----------

g). additional savings ----------
h). acquisition of farm land ----------
i). Storage of farm produce ----------
j). acquisition of irrigation pump ----------

C. WHAT ARE THE SOURCES OF AGRICULTURAL INFORMATION TO FARMERS

21. What are your frequent sources of information on improved maize production technologies?

a). Extension officers ----------
b). Extension Bulletin ----------
c). Newspapers ----------
d). Radio ----------
e). Television ----------
f). Agricultural show/field day ----------
g). Fellow farmers ----------
h). Friends/relatives ----------
i). Research Institute ----------
j). Organisations (ADPs) ----------
k). Cooperatives ----------

D. WHAT ARE THE FACTORS INFLUENCING THE ADOPTION OF IMPROVED MAIZE TECHNOLOGIES AMONG FARMERS

22. Have you being influenced by these improved maize technologies over the existing method of farming?

a). Yes ----------
b). No ----------

23. If yes, which of these influenced you most?

a). Level of education ----------
b). Easy access to finance/credit ----------
c). Age of the farmer ----------
d). Expectation of high income/high yield ----------
e). Membership of cooperatives ----------
f). Practicability of the method ----------
g). simple understanding of the method ----------
h). Demonstration on farm to farmers through symposium ----------
i). Low cost effective ----------

24. Which of the following maize production technologies do you adopt?
    a). Improved seeds
    b). Seed dressing
    c). Appropriate pest/disease control
    d) Appropriate quantity of organic and inorganic fertilizer
    e). Appropriate planting spacing
    f). Appropriate method of fertilizer application

E. EFFECT OF ADODPTION OF RECOMMENDED MAIZE PRODUCTION TECHNOLOGY:

25. Do you plant maize every year?
    a). Yes ---------- b). No. ----------

26. What are the benefits you expect from maize production?

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27. Does the adoption of recommended maize production technology have any positive effect on you?
    a). Yes ----------
    b). No. ----------

28. If yes, on what aspect?
    a). Yield/Output ---------
    b). Income ---------
    c). Standard of living ---------
    d). Others (specify) ---------

29.. With the adoption of recommended maize production technology how many bags (kg) did you obtain in 2009/2010 farming season?
    a). ----------

30. Does the increase in the yield commensurate with your level of satisfaction?
    a). Yes ----------
    b). No. ----------

31. From the income obtained as a result of adoption of the recommended maize production technology, are you able to solve some basic pressing life demands in form of?

a). Access to food ----------
b). Access to education ----------
c). Access to good house ----------
d). Access to social amenities (TV, VCD, Motor car, motor-cycle) ----------
e). Access to savings ----------
f). Adequate storage ----------
g). others (specify) ----------

E. WHAT ARE THE CONSTRAINTS FACED BY FARMERS IN THE ADOPTION OF IMPROVED MAIZE TECHNOLOGIES IN THE STUDY AREAS

32. Do you encounter constraints in the course of adopting these improved maize technologies?

a). Yes ----------
b). No ----------

33. If yes, what are the areas you encounter problems in the course of adopting these improved maize technologies?

a). Lack of credit ----------
b). Bad road network ----------
c). Lack of extension officers' attention ----------
d). Lack of good communication network ----------
e). Difficulty to access to input ----------
f). High interest rate ----------
g). No collateral to guarantee credit ----------
h). Organizations/cooperatives pre-conditions ----------