THE IMPLICATIONS OF INNOVATION DIFFUSION FOR RURAL DEVELOPMENT: A COMPARATIVE STUDY OF SOME VTLLAGE IN FUNTUA AND JEMA'A LOCAL GOVERNMENT AREAS OF KADUNA STATE

BY

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A thesis submitted to the Postgraduate School, Ahmadu Bello University, Zaria in partial fulfilment for the award of the Degree of Master of Science in Rural Development

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DEDICATION

Dedicated to my children, Grace,
Gloria and Godiya.

DECLARATION

I hereby declare that this thesis has been written by me and that it is a record of my own work. It has not been presented in any previous application for a higher degree. All the sources of information are specially acknowledged by means of references.

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CERTIFICATION

This thesis, entitled,"The Implications of Innovation Diffusion for Rural Development: A comparative study of some Villages in Funtua and Jema'a Local Government Areas of Kaduna State", by Mrs. Sarah Jehu Auta meets the regulations governing the award of Masters of Science Degree in Rural Development, Postgraduate School, A.B.U., Zaria and is hereby approved for its contribution to knowledge and literary presentation.

Chairman, Supervisory Committee Date: ----------

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ABSTRACT

Nigeria can achieve a high degree of self-sufficiency in agricultural production if appropriate improved farm practices are communicated and made available to farmers. This study examines the implications of innovation diffusion for rural development in Funtua and Jema'a Local Government Areas of Kaduna State, by comparing the adoption behaviour of farmers on four selected agricultural innovations: (improved maize varieties, fertilizers, ox-ploughs and tractors). The study was carried out by examining how factors like sources of information, age, education and accessibility influenced adoption behaviour of farmers. It was hypothesised that young and educated farmers who had access to official sources of information and lived in very accessible villages had a higher adoption rate than farmers who did not possess these characteristics.

The method used involved grouping villages into three categories according to their degree of accessibility (which was measured using the transportation network) from which sampled farmers were interviewed.

Findings from the study revealed that farmers are highly aware of the selected innovations. Adoption of innovations is however highest in the accessible villages. The extension workers were discovered to be the most effective source of information on improved farm practices. Age, and socio-economic characteristics were also found to positively enhance adoption of innovations. However

education does not seem to have influenced the adoption of innovations perhaps because the sources of information used involved mainly interpersonal face-to-face contact.

The implication of the findings is that the construction of a denser transportation network within the study areas, and provision of Farm Service Centres should be awarded high priority. Extension workers should be provided in adequate numbers and their selection should be based on their ability to effectively communicate to the farmers the necessary information. Small scale loans should be provided to the farmers to purchase inputs which should also be subsidised. There is also the need to organise adult education classes for farmers and to allow them to participate or at least keep them fully informed about decisions made on matters that affect their welfare.

The study also points out the need for constant innovation diffusion studies, which would help to monitor government efforts in trying to improve Nigeria's agricultural production and make it self-sufficient.

CHAPTER ONE

I N T R O D U C T I O N

1.1 Statement of the Problem

Recent advances in agriculture have been necessary because of the need to efficiently feed Nigeria's growing population. But the major problem here is that production is not keeping pace with the population growth despite great advances in agricultural research, mainly because of the slow adoption of recommended farm practices by the country's estimated 20 million peasant families (Olayide et al., 1979).

The process of increasing efficiency in agricultural production depends mainly on the extent to which farmers can incorporate into their farming operations improved technologies; that is, assuming the technologies are available and relevant to the farmers' situations. In order to adopt these agricultural practices, the farmers must first become aware of the existence of such practices, develop interest in them, evaluate them, try them, and become convinced of their relevance and usefulness before finally adopting them.

Research has shown that the process involves many stages and hence farmers rely on a variety of sources of information on improved farm practices. Voh (1984) observed that a steady flow of accurate, understandable and factual information links the scientist with the farmer through the various sources that communicate such information, particularly the extension services.

However, Onazi (1978) pointed out that Nigeria's research knowledge and output are nearly twenty years ahead of extension and farmers' practices, which he attributes to an inadequate ratio of extension workers to farmers, which has been put at 1:5000. Even where the extension services are available, a lot of resistance is met by the agents trying to introduce the new ideas to a traditional farming community. On the other hand, the extension worker could decide not to attend to a certain farmer for reasons best known to him. Thus a major motive force in rural development is the diffusion of technological innovations, because this will tend to raise agricultural production levels by small scale farmers.

The critical elements in the diffusion of an agricultural innovation according to the innovation-diffusion process proposed by Rogers & Shoemaker, (1971) are:

(i) The innovation;

(ii) The channels through which it is communicated;

(iii) The time span over which this communication takes place, and

(iv) The social system among whose members the process operates.

The adoption process may also be broken down into four stages, namely:

(i) Knowledge stage;

(ii) Persuasion stage;

(iii) Decision stage; and

(iv) Confirmation stage.

In spite of the existence of an innovation-diffusion model as above, Nigeria is still having problems of disseminating new ideas to the farmers. This may be due to the lack of complementarity between the research output and the field and extension workers, as earlier mentioned. It can also be attributed to the lag in the diffusion of recommended agricultural practices and to the apparent slow adoption or complete rejection of the practices by the Nigerian peasant farmers who are primarily responsible for the country's food production.

For spread effects to take place, a number of conditions should be satisfied. These according to Pottier (Hilhorst, 1972), are that, there should be a transportation network between the sending and receiving ends, and also, there should be ways of communicating the necessary information between the areas in question. The transportation network thus plays a vital role in the development of an area, through the stimulation of growth at points which Pottier refers to as 'Development axes'.

In northern Nigeria, the creation of various Agricultural Development Projects has provided an opportunity for the emergence of such development axes. Thus in Funtua area of Kaduna State, most villages are

more physically accessible due to the impact of the Funtua Agricultural Development Project (F.A.D.P.). However, in other parts of the state such as Jema'a area, only a few villages have motorable roads to them, which are mainly laterite and seasonal, while the majority of villages do not have motorable roads, but only foot-paths leading to them. This makes movement of goods and people difficult in the area. In terms of access to innovations, it is evident that they are concentrated in the hands of few individuals with better economic status in the two study areas. There is therefore, the need to make innovations available to the less privileged farmers who really need them.

Despite the fact that about two-thirds of Nigeria's population is involved in agricultural production, the country is still faced with food shortage and has to import large quantities of food from outside countries. Agricultural production still remains traditional, characterised by small holdings, low inputs and minimum returns. There is, therefore, a great need to improve both the quality and quantity of production to meet the growing demand. In the light of this, Baba (1979) observed that Nigeria's problem is not that of resource shortage, but rather one in which optimum utilization of available resources is being inhibited by various rigidities.

The essence of the research problem, therefore, is that despite the fact that we live more and more than ever before in an era of change, prevailing physical, social structures, personality and communication behaviour often hamper the diffusion of innovations. Mabogunje (1986, p.6) clearly puts it that "...their widespread adoption and dissemination have been constrained because of the obsolescent and inappropriate social structures". This has created a wide gap between what is known and what is effectively put to use. To bridge the gap created, we must understand how new ideas spread from their sources to potential receivers and understand the factors affecting the adoption of such innovations.

1.2 Aim and Objectives of Study

The aim of the study is to assess the implications of the diffusion of innovations for rural development, by comparing villages at different levels in terms of accessibility to innovations. Farmers' reactions to selected innovations will be studied in order to identify whether their reactions are of acceptance or rejection, and to explain the factors contributing to their reactions.

This will be achieved through the objectives of the present study which are to:

(a) examine the types and effectiveness of the various communication channels and sources of information available to the farmer;

(b) examine the relationship between social factors (literacy and age) and the adoption of new farm practices;

(c) examine the relationship between accessibility and the proportion of farmers adopting innovations;

(d) examine the consequences of adoption behaviour and identify the problems that may be found to inhibit the diffusion and adoption of new practices in the study areas.

In order to fulfil the objectives stated above, four innovations have been selected, each of which constitutes a recommended practice. They are:

(a) Use of fertilizer,

(b) Improved maize varieties,

(c) Tractor hiring services,

(d) Use of ox-plough.

These innovations have been selected since they are representative of the range of inputs which are commonly considered vital in the development of agricultural production. One of the major constraints in Nigeria's agricultural production is that of labour shortage. Production in northern Nigeria used to be done on communal basis, when the gandu system (the indigenous Hausa system of organizing labour on a cooperative basis) was in operation. The labour force under these circumstances was enough to produce enough food to feed the population and, in some instances, produce cash crops for export. With the break-down in recent decades in the gandu system, increase in the rate of population growth and increased monetization of the economy, labour has become a great constraint in agricultural

production. This is coupled with the fact that agricultural production in northern Nigeria is mainly restricted to the rainy season, which in the northern part of the study area may be as little as 6 months of the year. During this period, every farmer at the planting season is always busy on his farm with few people available to offer hired labour. There is, therefore, the need to supplement the farmers' simple and crude implements used for production if enough food is to be produced to meet the growing demand. This alternative may be provided by the introduction of the use of tractors and ox-ploughs in the study areas. But the question here is whether these implements are readily available to the farmers and appropriate to their socio-economic circumstances.

Also, while farmers in the study area in the past practised fallow systems or used compound manure to enrich their farms, increased population pressure on land has resulted in permanent cultivation leading to soil depletion and exhaustion. To resolve this, farmers increasingly have to use chemical fertilizers, though not enough is yet known about their possible adverse consequences on land. Improved maize varieties have also been found to have advantages like short maturing period and high yields as compared to the local varieties, so there is need for farmers to adopt them since most of the farmers have now realized the need to produce for the market to earn some cash. The above mentioned factors thus have prompted the selection of these four innovations, so as to know farmers' reactions to them and their implications for rural development.

1.3 Hypotheses

In order to fulfil the objectives of the study, specific attention will be paid to testing the following hypotheses:

(a) That farmers with access to formal sources of agricultural information have a higher adoption rate than farmers with access only to informal sources of agricultural information.

(b) That farmers with formal education have a higher adoption rate than farmers with no formal education.

(c) That younger farmers have a higher adoption rate than older farmers.

(d) That farmers living in very accessible villages have a higher adoption rate than farmers living in less accessible villages.

1.4 Methodology

To have a good basis for comparison, Funtua and Jema'a Local Government Areas have been chosen as the study areas (Fig. 1.1). The Funtua area is generally termed as being accessible to innovations because of the influence of the Funtua Agricultural Development Project (F.A.D.P.), established in 1975 and absorbed within the Kaduna State Agricultural Development Project in 1980. Jema'a area may be expected to be less accessible to innovations because the area lies outside the original F.A.D.P. area and came under direct influence of an agricultural project only in 1980, when the FADP was absorbed within the new state-wide Kaduna State Agricultural Development Project.

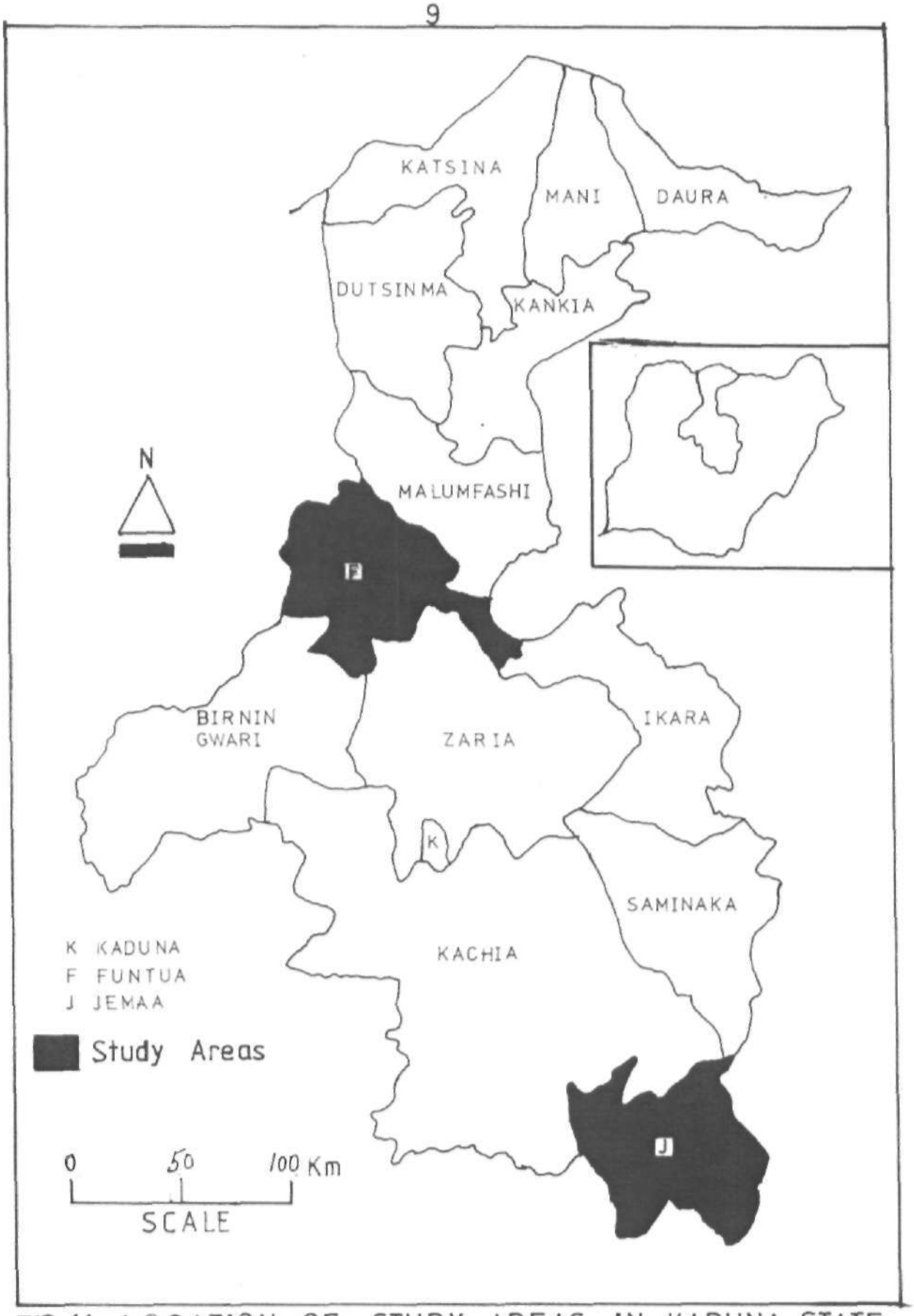


FIG 1.1 LOCATION OF STUDY AREAS IN KADUNA STATE
SOURCE: Idachaba F.S et. al. 1981

Since the aim of the study is to assess the implications of innovation diffusion for rural development, more emphasis will be focused on the Funtua area, while comparisons will be drawn from Jema'a area in order to highlight differences which reflect the different history of agricultural development in the two areas.

The sampled villages are grouped into three categories. The first category (I) comprises villages termed as remote. This group is made up of villages that do not have motorable roads to them but only foot-paths. To get to these settlements one has to use other means of mobility like motor-cycle, bicycle, donkey, etc. The second category (II) comprises villages that are moderately accessible. These are settlements with seasonal roads that are accessible to motor traffic for only part of the year. The third category of villages (III) are those that are highly accessible; that is, those having roads (most of which are now tarred) motorable throughout the year.

Three districts, Maska, Faskari and Bakori were taken from Funtua Local Government Area while only one district, Moro'a, was taken from Jema'a Local Government Area. The initial intention was to select three villages from each of the chosen four districts; however, this was not possible, in view of the fact that all villages in Funtua now belong to either categories II and III without any villages in the remote category (Category I).

In order to maintain equal numbers of sampled villages in the two areas and in the three categories, a different sampling procedure was therefore used, and Table 1.1 shows a summary of how the villages were selected.

Thus in Jema'a area, while villages under the three categories are represented, the largest number belong to category I. Names of selected villages are presented in Table 1.2, while their locations in relation to accessibility are shown in Fig. 1.2 and Fig. 1.4 for Funtua and Jema'a areas respectively.

Table 1.1: Distribution of sampled villages

Local Government Area	Categories of Villages			
	Cat.I	Cat.II	Cat.III	Total
Funtua	0	3	3	6
Jema'a	4	1	1	6
Total no. of villages	4	4	4	12

Source: Field Survey (1986)

Table 1.2: Names of villages selected from each district

Village Category	District				
	Funtua	Bakori	Faskari	Mo'ro'a	Total
I	- - - -	- - - -	- - - -	Mifi Ashim Mafan Zankan	4
II	Ruwan Gadiya	Yankwani	Maigora	F/Attakar	4
III	Dukke	Kurami	Machika	Manchok	4
Total no. of villages	2	2	2	6	12

Source: Field Survey (1986)

KASUM IBRAHIM

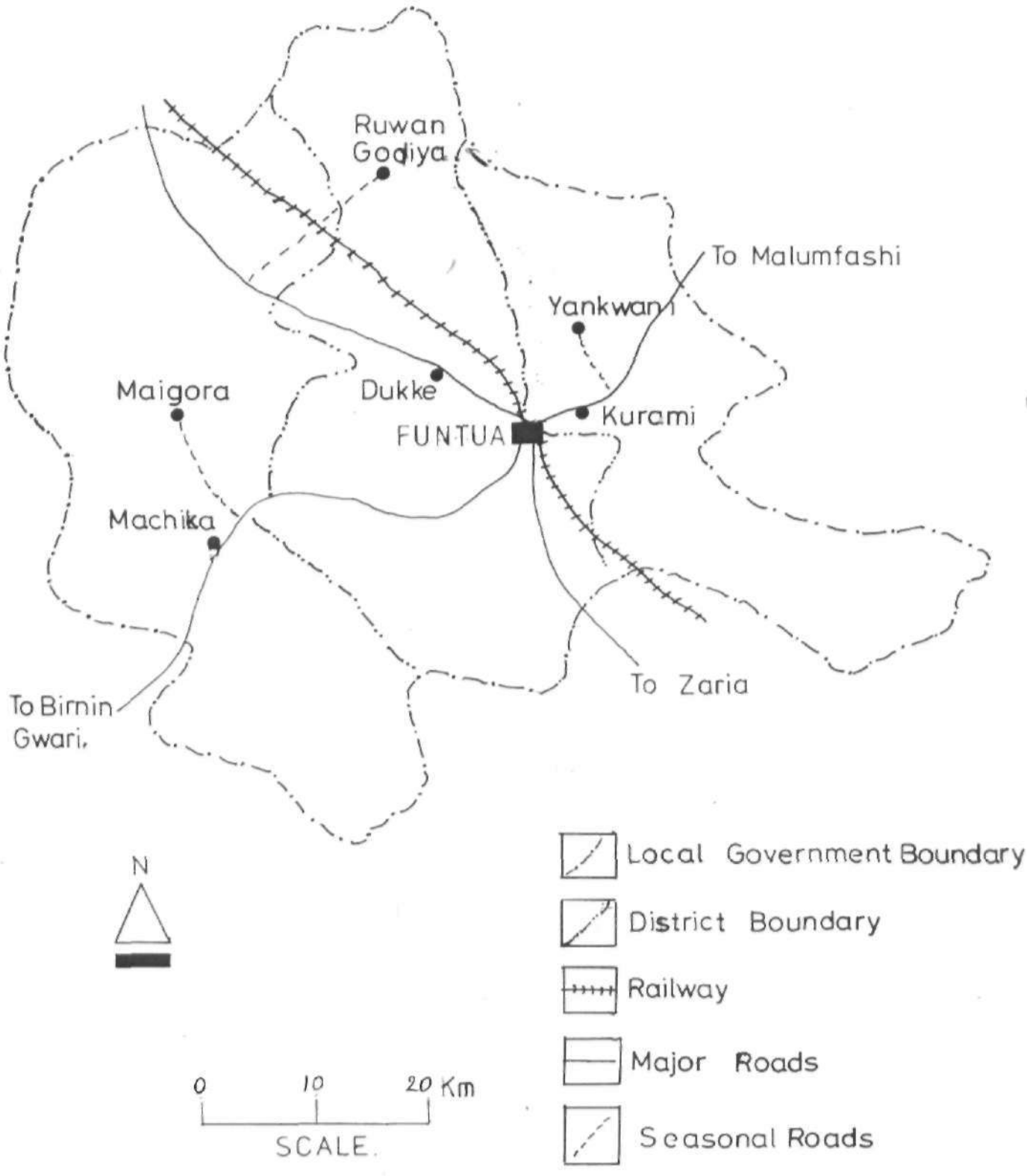


FIG 1.2 LOCATION OF SAMPLED VILLAGES IN FUNTUA LOCAL GOVERNMENT AREA.

SOURCE: Local Government Office, Funtua.

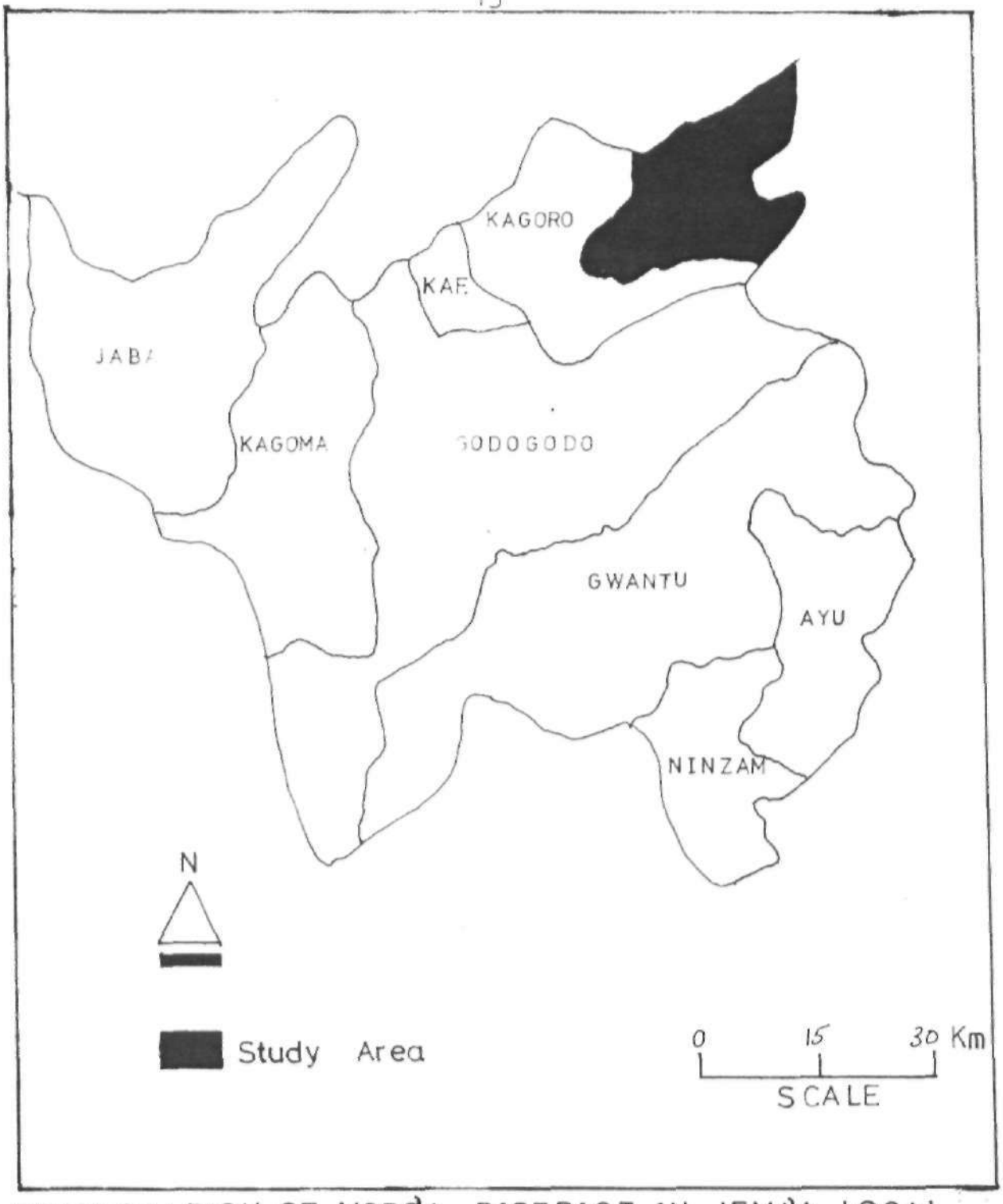


FIG1·3 LOCATION OF MORÒA DISTRICT IN JEMÀA LOCAL GOVERNMENT AREA.

SOURCE: Local Government Office, Kafanchan.

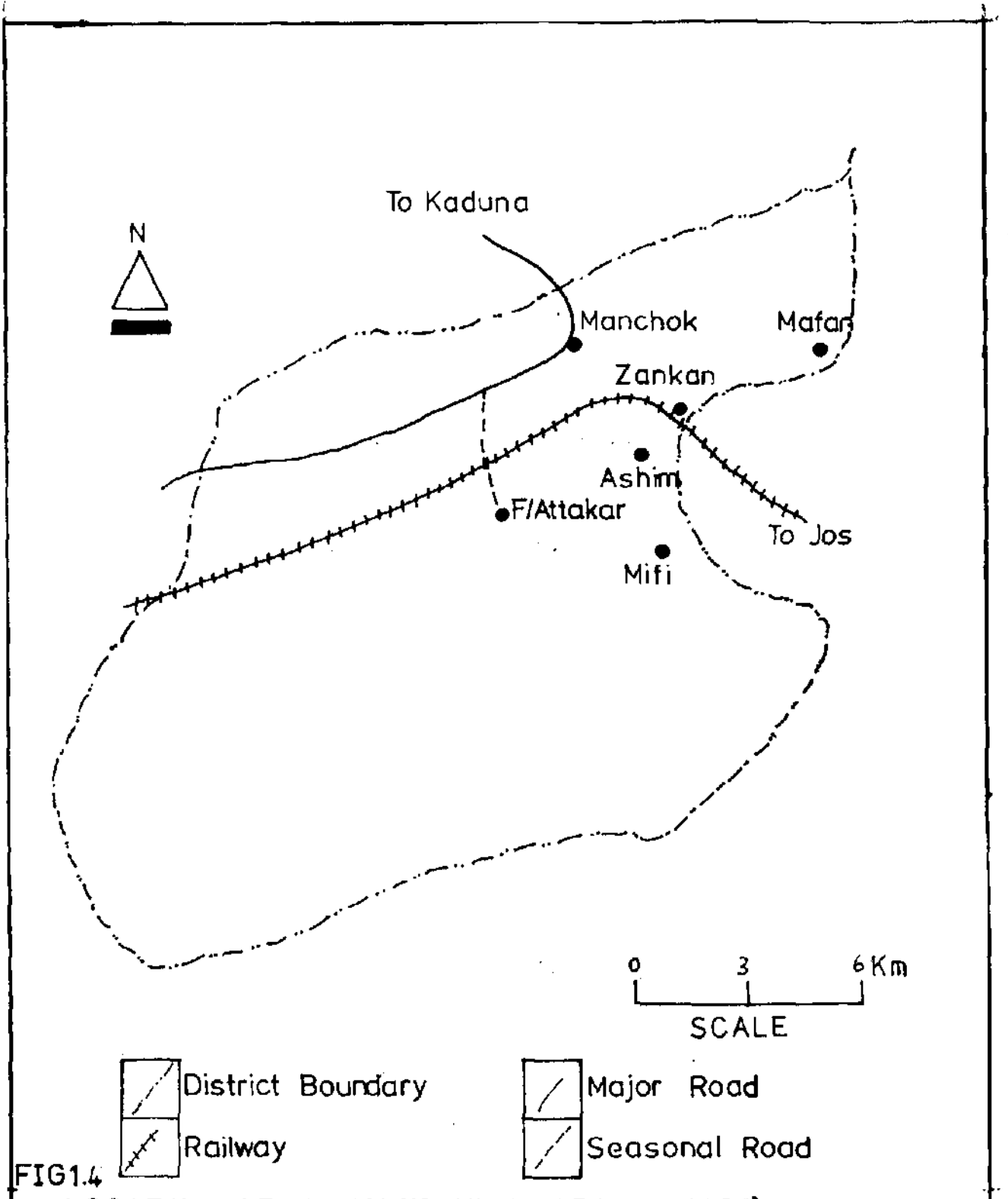


FIG1.4 LOCATION OF SAMPLED VILLAGES IN MORO'A DISTRICT

SOURCE Local Government Office. Kafanchan.

Data for this study were derived mainly from primary sources. Three sources were employed.

(a) The first source was by using a structured interview schedule for farmers. A total number of 320 questionnaires was administered to randomly chosen farmers in the chosen villages. Table 1.3 shows the number of farmers in each category that were interviewed.

Table 1.3: Number of farmers interviewed from the study areas

Village Category	Number of Respondents	
	Each village	Total in each Category
I	15	60
II	25	100
III	40	160
Total no. of respondents	-	320

Source: Field Survey (1986)

Looking at the structural organization of the E.A.D.I., it was discovered that there was a concentration of extension advice to a certain category of farmers who constitute just a minority of the farmers. These extension activities tend to be more in the very accessible villages, decreasing with decrease in the level of accessibility so that in the most remote villages, there are no extension workers at all.

The sampling of different numbers of respondents from villages of different categories was thought appropriate since the more accessible villages may be expected to contain a wider range of different categories of farmers. This is because farmers in the remote villages tend to be using the same methods of production since they operate in a system which can be referred to as 'semi-closed' to sources of change, while production tends to vary from one farmer to the other with an increasing trend as one moves to the more accessible villages.

(b) The second source of data was obtained by administering questionnaires to extension workers in some of the 12 selected villages (since not all villages have extension workers). Distribution of this set of questionnaires (30 in number) was as follows: 4 questionnaires each were administered to extension workers in two villages under Category III, while the remaining two villages had 5 questionnaires each making a total of 18 questionnaires for extension workers in villages under Category III. Four questionnaires were administered to extension workers in each of 3 villages under Category II, making a total of 12 questionnaires for Category II. One village in category II and all the four villages in Category I did not have extension workers in them.

(c) Data were also collected from interviews held with project officials in Funtua and Kaduna.

The data obtained were analysed using statistical methods. Responses from farmers on the various findings were reported by frequency distributions. Percentages were then calculated from which descriptions and inferences were made to reflect the objectives of the study.

Chi-square tests were carried out to find out the following:

(a) Whether there is a significant difference between the 3 categories of villages in type of labour used.

(b) Whether there is a significant difference between adopters and non-adopters in the type of sources of information used.

(c) Whether there is any significant difference between age level in adoption of innovations.

(d) Whether there is any significant difference between literacy levels in adoption of innovations.

(e) Whether there is any significant difference between the 3 village categories in adoption of innovations.

1.5 Scope and Limitations of Study

The study examines the factors affecting the diffusion of innovations in Funtua and Jema'a Local Government Areas of Kaduna State. The channels of communication are examined, as are the factors responsible for either the acceptance or rejection of the innovations. Two social factors, age and literacy, are also examined to find out how they influence the adoption of the selected innovations. The study also examines the implications of the farmers' adoption behaviour for the welfare of the people concerned.

There were, however, factors like cost and time which were limitations to the study. The interviews were mainly done by field staff who were instructed on how to interpret questions to the farmers, since it was not possible for the researcher to supervise all the interview sessions. Most farmers in Nigeria have a negative attitude towards government personnel asking questions about their socio-economic status for fear of being taxed heavily, so a major limitation of this study was the possibility that farmers would give false answers to certain questions. To check against this, a brief introduction of the aim and objectives of the study preceeded the actual interview. Information given by the farmers, however, was dependent on how much they could remember at the time of the interview, especially on the past events.

1.6 Definition of Concepts

In the literature of innovation diffusion, a number of concepts are employed with specialized meanings. The definitions which are often used in the course of the present study are derived from Rogers and Shoemaker (1971).

(a) Selective contact - change occurs when outsiders intentionally or spontaneously communicate a new idea to members of a social system who in turn select those ideas they accept. The receivers of these new ideas choose, interpret, adopt or reject the innovations according to their needs.

(b) Directed contact - planned change is caused by outsiders who, on their own or as representatives of change agencies, seek to introduce new ideas in order to achieve definite goals. In the case of directed change, the innovations as well as the recognition of the need for the change originate outside the social system.

(c) Communication - is the process by which messages are transferred from a source to one or many receivers.

(d) An innovation - is the idea perceived as new by those who are confronted with it as an option of choice.

(e) Innovativeness - the degree to which a farmer is relatively earlier in adopting recommended practices as compared to other farmers in his social system.

(f) Awareness knowledge - knowledge that an innovation or idea exists.

(g) Application knowledge - information necessary for adoption of an innovation by an individual.

(h) Adoption - the acceptance, incorporation and continued use of a recommended agricultural innovation by a farmer.

(i) Rejection - this is the non-acceptance of a recommended practice by a farmer, as distinct from "discontinuance" which is the rejection of a recommended practice that has been previously adopted.

(j) Diffusion - is the process by which messages are transferred from a source to one or many receivers.

(k) In addition, the concept of a "recommended practice" is used in the present study to refer to an "Extension innovation, improved farm practice, new improved technology or recommended extension package" (Ichue, 1986).

(l) Rural development - this has been defined by Mabogunje as the socio-economic transformation of a nation's rural economy from being a peasant subsistence agricultural economy to a modern commercialized (socialized) agricultural enterprise, with all the social structures it entails. Besides socio-economic transformation, it entails issues of growth, modernization, and distributive justice, and goes beyond this to create new social structures within which the gains of the rural population from all of them can be consolidated and reinforced in a cumulative upward performance (Mabogunje, 1986).

CHAPTER TWO

LITERATURE REVIEW

Rural societies can be transformed by injecting into them leading innovative forces. Thus the ability of that society to effectively adopt relevant innovations would eventually lead to changes from a traditional way of life of the people concerned, and a rise in the standard of living over time.

A lot of research has been done on both the social and spatial dimensions of innovation diffusion by various scholars. In this study, attention will be mainly paid to the social dimension of innovation diffusion. But at this juncture, it might be necessary to examine some of the characteristics of innovations.

2.1 Characteristics of Innovations

Among members of a social system, some innovations diffused from first introduction to widespread use in a few years. Yet another innovation may require several years or even up to fifty years to spread (Rogers and Shoemaker, 1971). As observed by Alao (1974), agricultural innovations vary tremendously in their inherent characteristics, which to a large extent influence the decision of the farmer to adopt or reject them. Experts have observed that it is the receiver's perception of the attributes of innovations, not the innovations themselves that affect their rate of adoption.

Among these characteristics according to Rogers and Shoemaker (op.cit.) are:

(a) Relative Advantage - This has been defined as the degree to which an innovation is perceived as being better than the idea it supersedes. The relative advantage is often expressed in economic or social terms. Rogers and Shoemaker found out in a study of small-scale farmers in the United States that a decrease in comfort, which is one sub-dimension of relative advantage, is positively related to the rate of adoption. If the effects of an innovation can be demonstrated to the clients by the change agents immediately, then the rate of adoption of such an innovation will be high.

Economic profitability as a sub-dimension of relative advantage is less important as a predictor of rate of adoption for small U.S. farmers than for larger farmers (Kilvin and Fleigel cited by Rogers and Shoemaker)(1971). This finding leads one to guess that economic profitability may even be less important for peasant farmers in less developed countries.

An economist, Schultz (1964) argued against the prevailing view that socio-cultural variables are important determinants of rate of adoption of innovations among peasants in less developed countries; but that economic stimuli greatly affect peasants and to such an extent that we do not need to attend to cultural factors. He said that studies of the observed lags in the acceptance of particular new agricultural factors (that is innovations) show that these lags are explained satisfactorily by profitability.

Since differences in profitability are a strong explanatory variable, it is not necessary to appeal to differences in personality, education and social environment. Schultz puts it in other words that relative advantage is the only attribute of innovations affecting their rate of adoption.

Rogers and Shoemaker (1971) did not agree with Schultz's view. They argued that though economic consideration is a predictor of the rate of adoption of innovations by peasants, it cannot over-rule the other perceived attributes like socio-cultural variables. This they said backing with the fact that Hindus would never begin to eat cows even if the price of beef were to be halved in India.

Another sub-dimension of relative advantage is economic incentives or subsidies offered to clients in order to speed the rate of adoption of an innovation. This is evident in the case of Nigeria where the subsidy on prices of fertilizer had encouraged farmers to adopt the innovation, which is in high demand today even though the subsidy has been removed.

(b) Compatibility - This is defined as the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of receivers. Compatibility ensures greater security and makes the new idea more meaningful. An innovation may be compatible with socio-cultural values and beliefs.

According to Fals Barde (cited by Rogers and Shoemaker 1971) the introduction of the Scythe for harvesting grains was quickly accepted by peasant communities in Colombia because its use was just like the sickle they have been using. He also discovered that some farmers applied chemical fertilizers on top of their potato seeds (as they had done with cattle manure) thus damaging their seeds and causing a negative evaluation of the innovation. Apodaca (cited by Rogers and Shoemaker, 1971) discovered that though hybrid maize which was introduced in a New Mexico county has yields three times the local variety, it was not accepted because of taste preference for the local variety over the new one. Similarly, Raza and D'Silva (1980) also observed the preference for the local variety of maize to be one of the reasons for the low rate of adoption of project maize by farmers in the Funtua area.

(c) Complexity - This is defined as the degree to which an innovation is perceived as relatively difficult to understand and use. Some innovations are clear in their meaning to potential adopters, while others are not. The complexity of an innovation as perceived by members of a social system is negatively related to its rate of adoption (Rogers and Shoemaker, 1971).

(d) Triability - This is defined as the degree to which an innovation may be experimented with, on a limited basis. New ideas that can be tried on an instalment plan will generally be adopted more rapidly than innovations that

are not divisible. An innovation that is triable is less risky for the adopter. The triability of an innovation as perceived by members of a social system is positively related to its rate of adoption.

(e) Observability - This is the degree to which the results of an innovation are visible to others. The observability of an innovation as perceived by members of a social system is positively related to its rate of adoption.

2.2 Characteristics of Adopters

All individuals in a social system do not adopt an innovation at the same time. Rather they adopt in an ordered time sequence. Adopters may be classified into categories on the basis of when they first begin using the new idea, with each category containing individuals with a similar degree of innovativeness. Emphasis on innovativeness in diffusion research, especially in less developed countries, is because innovativeness is the best single indicator of modernization (Rogers and Svenning, 1969).

Researchers have used time as the variable to classify adopters into categories and to plot diffusion curves. They have shown that adoption of innovations follows a normal, bell-shaped curve when plotted over time on a frequency basis. If the cumulative members of adopters is plotted, the result shows an S-shaped curve. The S-shaped adopter distribution rises slowly at first when there are few

adopters in a time period. Then it accelerates to a maximum when half of the individuals in a system have adopted, then reduces to a slower rate as the few remaining individuals finally adopt. The S-shape curve according to Rogers and Shoemaker (1971) is said to be normal because of two reasons. Firstly in a learning curve, the gain in learning per trial is proportional to the product of the amount already learned and the amount remaining to be learned before the limit of learning is reached. Secondly, the normality can be because of diffusion-effect. This is the cumulatively increasing degree of influence upon an individual within a social system to adopt or reject an innovation. This influence results from the increasing rate of knowledge and adoption or rejection of an innovation in the system which is as a result of human interaction.

Innovativeness, which is the degree to which an individual is relatively earlier in adopting new ideas than other members of his social system has been used by Rogers and Shoemaker (1971) to classify adopters into five categories. They are:

Innovators;

Early adopters;

Early majority;

Late majority;

Laggards.

(a) Innovators - They have cosmopolitan social relationships. They are a group that are eager to try new ideas. Being an innovator, one needs to control a substantial financial resource to absorb a possible loss due to unprofitable innovations and the ability to understand and apply complex technical knowledge. He takes risk and is also willing to accept occasional set backs when the new idea he adopts proves unsuccessful.

(b) Early Adopters - Whereas innovators are cosmopolites, early adopters are localites. They have the greatest degree of opinion leadership in most social systems. Potential adopters look to this group for advice and information about the innovation. This group is generally sought by change agents to be used in speeding the diffusion process because they serve the role of a model for many other members of a social system.

(c) Early majority - This group adopt new ideas just before the average member of a social system. They do not hold any leadership position. They may deliberate for some time making the innovation-decision relatively longer than that of the innovators and early adopters. They follow with deliberate willingness in adopting innovations, but seldom lead.

(d) Late majority - They adopt just after the average member of a social system. Adoption may be both an economic necessity and increasing pressure. They are sceptical about innovations and as such the weight of system norms must definitely favour the new idea before they are convinced.

(e) Laggards - These are the last group to adopt an innovation. The point of reference for the laggards is the past, where decisions are usually made in terms of what has been done in previous generations. Individuals here interact with others who have traditional values. When they finally adopt an innovation, it may already have been superseded by another more recent new idea which the innovators are already using. This is because the laggards tend to be suspicious of innovations, innovators and change agents due to their traditional values.

Rogers and Shoemaker thus sum up by saying that the dominant values each category has are:

Innovators	-	Venturesome
Early adopters	-	Respectable
Early majority	-	Deliberate
Late majority	-	Sceptical
Laggards	-	Traditional.

Having looked at the characteristics of innovations, and these of adopters, it might be necessary to examine the diffusion-adoption theory for a better understanding of how new ideas are spread in a social system.

The diffusion-adoption theory is made up of two components, namely:

1. The diffusion process.
2. The adoption or innovation-decision process.

According to Rogers and Shoemaker (1971), the diffusion process comprises four elements:

(a) The innovation, which is defined as an idea, practice or technology that is perceived as new by an individual;

(b) The channels through which it is communicated;

(c) The time span over which this communication takes place, and

(d) The social system among whose members the process operates.

Thus the process involves the transmission of information about an innovation from a source to the potential users.

Diffusion scholars have long recognised that an individual's decision about an innovation is not instantaneous act, rather it is a process that occurs over a time period and consists of a series of actions.

The innovation-decision process otherwise called the adoption process, was postulated by a committee of rural sociologists (R.S.S.S., 1955) as consisting of five stages:

1. Awareness stage - The individual learns of the existence of the new idea but lacks information about it.
2. Interest stage - The individual develops interest in the innovation and seeks additional information about it.
3. Evaluation stage - The individual makes mental application of the new idea in his presence and decides whether or not to try it.

4. Trial stage - The individual actually applies the new idea on a small scale in order to determine its utility in his own situation.
5. Adoption stage - The individual uses the new idea continuously on a full scale.

The above conceptualization of adoption process has been criticised by Rogers and Shoemaker as being too simple because of the following deficiencies:

(a) It implies that the process always ends in an adoption process, whereas, rejection may also be a likely outcome. Therefore a term more general than adoption process is needed, that allows for either adoption or rejection.

(b) The five stages do not always occur in the specific order given, because some stages may be skipped. Also evaluation actually occurs throughout the process and not only at one of the five stages.

(c) The process seldom ends in adoption, as further information may occur to confirm or reinforce the decision, or the individual may later switch from adoption to rejection.

To make up for the deficiencies, Rogers and Shoemaker (1971) postulated the innovation-decision process which consists of four stages:

1. Knowledge stage - The individual is exposed to the innovation's existence and gains some understanding on how it functions.

2. Persuasion stage - The individual forms a favourable attitude towards the innovation.
3. Decision stage - The individual engages in activities which lead to a choice to adopt or reject the innovation.
4. Confirmation stage - The individual seeks reinforcement for the innovation-decision he has made but he may reverse his previous decision if exposed to conflicting messages about the innovation.

The innovation-decision process can be summarised to be the mental process through which an individual passes, from knowledge of an innovation to a decision to adopt or reject the new idea.

2.3 Consequences of Innovations

These are the changes that occur within a social system as a result of the adoption or rejection of an innovation. An innovation is of little use until it is distributed to others and put to use by them. The invention and diffusion are but immediate means to an ultimate end; the consequences from adoption of an innovation. Researches have given little attention to consequences of innovations and so also have change agents, because they often assume that adoption of a given innovation will only produce beneficial results for its adopters. Change agents should recognise their responsibility for the consequences of innovations they introduce, and should be

able to predict the advantages and disadvantages of an innovation before introducing it to their clients, which they seldom do.

Innovations precipitate both extensive and complicated chains of events. Many of such consequences both positive and negative are not always expected by change agencies. Rogers and Shoemaker (1971) illustrated this by studying the social effects of farmers' mechanization in 20 Turkish villages 10 years after a program of planned change was initiated. Prior to mechanization the people of the little valley in which the study villages were located lived a slow-moving isolated peaceful kind of life. Communication was extremely limited. The roads were crude, dangerous and few motorised vehicles ventured on them. The agricultural innovations devised at the research station failed to spread to the villages because of lack of proper communication between government workers and the peasants. Finally the Turkish government with the help of change agents known as the U.S. Agency for International Development began a massive change programme which included the introduction of 40,000 tractors, a variety of other farm equipment, a huge road-building programme and large numbers of motor vehicles. The impact was immediate and dramatic. The communication system was greatly improved and local agriculture was rapidly transformed. Under the programme, the amount of cultivated land owned by a village determined the types of crops and rate of mechanization. If a village had a large area of cultivated land, they started using

tractors and concentrated exclusively on raising only one crop such as cotton. On the other hand, a village with smaller area of cultivated land got only few tractors and was required to retain a diversified type of agriculture. This meant that smaller villages were hit by economic competition. The development of an improved communication system with the outside world produced an abrupt break with the isolated tradition of the village. Construction of better roads brought villages closer together both psychologically and geographically. Peasants began commuting to neighbouring villages by regular bus services and tractors, while some found work in the city while continuing to live in the village. Curiosity regarding new products, plus new-found ability to purchase them, produced eagerness to travel to urban centres resulting ultimately in migration towards urban areas. Not only was cosmopolitaness increased, but the old way of life was considered backward and doomed to disappear. Commercial farming has now replaced subsistence living.

Rogers and Shoemaker observed that the extensive changes brought by the mechanization programme were also attended by a number of undesirable consequences. The newly acquired farm equipment lasted only a relatively short time because of inexperience in mechanical maintenance and carelessness in use resulting from the ease with which the equipment had been acquired. Many of the tractors were idle because of lack of parts and improper maintenance.

Social status differences were emphasised by the new economic and social change, since poor villages with little land could not buy farm equipment and were forced to continue using old tools and traditional farming methods. Also villagers at the bottom of social scale who were now aware of the possibilities of economic development but were little affected by it became frustrated. A feeling of hopelessness and sorrow arose among those not fortunate enough to share in the higher incomes.

There is evidence here that the mechanization was initiated without due regard or understanding of village and social structure and without envisioning the social consequences likely to result from improperly planned mass mechanization, because the process directly benefited only a limited number of villages and a few individuals in each village who were mainly those already in the upper income group, while the poor remained poorer and some were even worse off than they were before the introduction of the programme.

The above illustration has shown how consequences can either be desirable or undesirable. They can further be classified in a more comprehensive way for a better understanding of their nature and their different types.

2.3.1 Functional Versus Dys-functional consequences

Functional consequences are desirable effects of an innovation in a social system, while dys-functional consequences are undesirable effects of an innovation in a social system. The degree to which consequences are desirable or undesirable ultimately depends, of course, on how innovations affect the members of the system. The determination of whether consequences are functional depends on how the innovations affect the adopters.

Any social system has certain qualities which should not be destroyed if welfare of the system is to be maintained. This might include family bonds, respect for human life and property, maintenance of individual respect and dignity, etc. Other socio-cultural elements are more trivial and can be modified, discontinued or supplanted with little impact either positive or negative. An innovation may be functional for a system, but not functional for certain individuals in the system. Rogers and Shoemaker (1971) illustrated the functionality of innovations using the example of adoption of "miracle" varieties of rice and wheat in India that led to what is called 'Green Revolution'. This innovation produced higher crop yields and more income to the farmer who adopted. Yet it also led to a smaller farm labour force, a hastened farm-city exodus to urban slums, higher unemployment rates in the nation, and political instability. So, although certain individuals profit from the adoption of the new seeds, it causes important but unequal conditions for the system.

Rogers and Shoemaker concluded that an innovation may be more functional for some individuals than others. This they supported with the fact that innovators frequently secure a kind of economic gain over the laggards called "windfall profits". (These are a special advantage earned by the first adopters of a new idea in a social system). Their unit costs are usually lowered and their addition to total production have little effect on the price of product. An innovator must take risk in order to earn windfall profits, but since not all new ideas turn out to be successful, he sometimes gets his finger burned and suffers "windfall losses". Windfall profits are therefore rewards for innovativeness and a penalty for laggardness.

2.3.2 Direct Versus Indirect Consequences

Direct consequences are those changes that occur immediately in a social system, while indirect consequences are changes in a social system that occur due to direct consequences. The introduction of the wet-land rice to a tribe in Madagascar studied by Linton and Kardiner (cited by Rogers and Shoemaker, 1971) illustrated this. The tribe were initially a nomadic group who grew dry-land rice. With the adoption of the new innovation, a pattern of land ownership developed, social status differences appeared, the nuclear family replaced the extended clan and the tribal government changed.

2.3.3. Manifest Versus Latent Consequences

Manifest consequences are changes that are recognised and intended by members of a social system; for example, the development of new occupational skills such as that of tractor repair necessitated by the mechanization of Turkish agriculture. Latent consequences on the other hand are neither intended nor recognised by the members of a social system.

It is evident that no innovation comes without any string attached. The more important, the more advanced, the more modern the innovation (and therefore the more desired by the change agents for its rapid adoption), the more likely its introduction is to produce many consequences; some of them intended and manifest, others unintended and latent, some functional and others dys-functional, etc.

2.4 Experiences from Comparative Studies

The acceptance of new farm practices does not occur by simply recommending them to farmers. Perhaps not unexpectedly, a lot of resistance is met by the extension agent in trying to introduce these new ideas to traditional farmers. Some of the factors that have been used to classify farmers into acceptors or non-acceptors include cultural, personal, social and situation factors (Lionberger, 1960). Gana (1980), in his study found out that an innovation is adopted as long as it is economically feasible, culturally adaptable and technically viable. The study by Gana was

carried out in 1976 to identify the processes of innovation diffusion in the rural areas of Funtua and Malumfashi Local Government Areas of Kaduna State. As the F.A.D.P. was then in its early stages, emphasis was placed on discovering any socio-economic, cultural or technical constraints to the effective adoption of such agricultural innovations as the ox-plough and fertilizer. Results from the study show that the adoption of fertilizer was found to be very rapid since its application is simple and compares closely with the traditional system of applying manure. The adoption of the ox-plough on the other hand was comparatively small because of economic and technical problems. He then concluded that rural producers will adopt innovations as long as they were economically feasible, culturally adaptable and technically viable.

Ten years after Gana's work, the present study in the Funtua area seeks to build on his findings by introducing a comparative basis. Villages have been grouped into different categories in terms of accessibility. But since the impact of the Funtua Agricultural Development Project has made it possible for every village in this area to be accessible, villages in the remote category were taken from Jema'a Local Government Area. This is done with a view to understanding how new ideas spread from various sources to potential receivers, and to understand the factors affecting their adoption.

In the study of sources of information on improved farming practices in the former Western Region of Nigeria, Williams and Williams (1971) found that the three most important sources of information were the agricultural extension agent, fellow farmers and the radio in decreasing order of importance. However, Yazidu (1975) working in the northern states of Nigeria found radio to be the most important source of agricultural information for farmers. He said this finding should not be surprising as the transitor radio is spreading rapidly and getting popular among literate and illiterate people in the area. Furthermore, this finding can be attributed to good radio programmes on farming matters, that is, the Nigerian Broadcasting Corporation (NBC) since 1932, the Broadcasting Company of Northern Nigeria (BCNN) since 1962 and A.E.R.I.S. since 1967, have been broadcasting in Hausa and nine vernacular languages in the north. Williams and Williams (1971), and Clark and Akinbode (1968) who also worked in the defunct Western State found that extension agents, radio and cooperative union staff were the most regular sources of agricultural information for farmers. Also mass media exposure for a farmer was indexed by his access to and use of various mass media such as radio, agricultural newsletters, newspapers and television and invariably in that relative order of importance (Alao, 1974). All studies so far conducted in Nigeria have shown a strong positive relationship between adoption of innovations and mass media exposure by farmers. Alao (Ibid.) however, pointed out that the media constitute a predisposing factor to farmers' adoption only to the extent that the mass media carry agriculturally relevant

information treated in the way that could be understood by the farmers.

Williams and Williams (1971) found that although both educated and uneducated farmers relied on the radio equally as a source of agricultural information, the educated farmers, however, tended to use the extension agent far more than the uneducated farmers did. D'Silva and Raza (1980) found that the extension workers serve as a very effective channel of communication in Funtua area with a change in ratio of extension workers to farmers from 1:2240 to 1:277 nearly four years after implementation of the F.A.D.P., a situation which has not been achieved even in most developed countries. Contrary to this view, Bogunjoko (1980) and Opeke (1977) in their studies of Giwa district and Western Nigeria respectively, discovered that extension workers do not serve an important source of information because of the ratio which was put at 1:1500 (Onazi 1978) as against the recommended ratio of 1:1000. Williams and Williams (op.cit.) also established that whereas the use of radio as an information source had some significant relationship with the age of the farmers, demonstration plots as a source of farm information had no relationship with the age, education, farm experience, and size and number of plots of farmers.

Mirchaulum (1976) in his study discovered that official sources of information (village head, agricultural show and radio) accounted for about 74 per cent of total sources used by farmers in Longuda district in Gongola State on the adoption of ox-plough. The village and compound heads accounted for 48 per cent of the first source of information on the ox-plough in the same study.

Age has been suggested by Ali (1977) to be negatively associated with acceptance of certain practices (that is, the older one is, the less he is likely to adopt new practices). He said that considering the tradition which the older farmer has, his behaviour, his responsibilities which increase his aversion to investment and his pending retirement which may reduce his motivation to maximise income and profit, then surely the younger farmer is more likely to adopt. Moreover, the younger farmer is in a much stronger state of health and also is more likely to undertake practices that will require an extra effort. Additionally, being a member of the younger generation, he is likely to get on with new things as they are.

The above mentioned factors clearly favour the younger farmer and all things being equal, he is much more likely to adopt new practices. But constraints abound for the younger farmer which Ali has found to be coupled with some advantages the older farmers have. These include the fact that land is normally headed by an elderly member of the family and also, there is a mass drift of young men from the villages in search of white collar jobs. This automatically means that a sample of farmers are left who, even if they are willing and ready to accept new ideas, do not have the physical ability to sustain rigorous and arduous tasks required by the agricultural profession. Clark and Akinbode (1968) and Alao (1974) in their various studies have supported the above view with the fact that the mean age of Nigerian farmers is between 45 and 50 years, placing them in a difficult situation to adopt new practices.

Education is another factor that affects the level of adoption of innovations. By education here we are looking at the formal type of education which brings up and instructs people with the aim of developing and strenghtening their powers of the mind. The relationship between acceptance of a new farm practice and education has been found to be of a positive nature, with the educated farmers occupying the upper and earlier adopter categories and the non-educated falling into the lower and late adopter categories (Rogers and Shoemaker, 1971). Contrary to this view, Dana (op.cit.) in his study discovered that the rate of adoption of fertilizer bore no relationship at all with educational level since the application of fertilizers to crops is a relatively simple technique. This implies that the rate of adoption of an innovation with respect to educational level will depend on the simplicity or complexity of the innovation in question.

Education's contribution to innovativeness can be looked at from many angles. For example, it helps in the stranger communication opportunities that become open to the educated farmer in the form of bulletins, posters, letters, etc that he is able to read to make him a more aware person than a person who cannot read. By being aware of the practices, the adoption process is at the starting point as postulated by the R.S.S.S. (1955) innovation adoption process. Also education is associated with the development of mental powers; the rigidity and adherence to tradition which characterised the non-innovative traditional farmer

may not exist in the educated farmer which allows him to use his reasoning capacity to do things. Thus education creates a favourable mental atmosphere for the acceptance of new practices.

Higher income, from various studies, is found to bear a positive relation with rate of adoption; that is, the higher the income, the higher the level of adoption. Rogers (1962) reported that in over 18 studies he carried out, wealth and innovativeness go hand in hand. This view was supported by Lionberger (1960) where he maintained that high farm income is associated with farm practice adoption level. With respect to this income-adoption relationship there is something of a reciprocal cause and effect relationship. It is agreed that the wealthier farmer usually is likely to adopt sooner because the innovation may require high initial capital that low income farmers cannot afford for obvious reasons. Moreover even where the low income earner can afford the capital he may not be willing to invest on a risky venture which may have undesirable consequences to his economic standard if he fails. The cause and effect relationship comes in where one understands that innovations bring about higher income which will permit the adoption of more innovations and the cycle continues in that manner.

Participation in organization is generally considered an important positive variable in adoption of new practices. Rogers generalized that earlier adopters have more social participation than later adopters. This has been confirmed in some Nigerian studies which have found a positive

statistically significant relationship between social participation and adoption (Clark and Akinbode, 1960; and Ichue, 1986). Organizations in whatever form base their effect on innovativeness on the fact that they provide opportunities for people to meet and discuss things. This may create awareness of some innovations which some may never have heard of, and may subsequently lead to adoption. The discussions could also serve as media for solving problems which some persons might have been nursing for a long time. Thus as Ichue puts it, participation in voluntary social organizations is a vehicle for exposure and access to information and also a means of gaining valuable learning experiences.

2.5 The Spatial Diffusion Process

Geographic space refers essentially to the earth's surface and the varying attributes of that space. These attributes comprise not only the visible features due to either natural processes or human construction, but also non-visible valuation due to social signification.

In terms of socio-economic formation Mabogunje (1980) has identified three ways in which space can be conceptualized. First, space can be regarded in an absolute sense as a thing in itself with a specific existence. Second, there is relative space which emphasizes relationships between objects and which exists only because those objects exist and are related to each other. Thirdly, there is relational space in which space is conceived as containing and representing within itself other types of relationships which exist between objects. In terms of human activities, according

to Mabogunje, the second and third conceptualizations are clearly the more significant. This is clearly because the location of objects and the perception and social evaluation both of the objects and their location do influence the pattern of behaviour of members of a given society.

The first geographer to develop a model to describe the diffusion of an innovation over-space was Hagerstrand in 1953 (Brown and Moore, 1969). He studied the acceptance of various new agricultural practices in an area of central Sweden and showed how the innovation spread outwards from an initial centre. He then developed a four stage model in which he identified what he termed "innovation waves". The four stages as adapted from Ichue (op.cit.) are:

(i) The primary stage - this marks the beginning of the diffusion process with a strong contrast between the innovating centres and remote areas.

(ii) The diffusion stage - this marks the diffusion process proper, in which there is a strong centrifugal effect with the creation of new, rapidly growing centres in the distant area and a reduction in the regional contrasts of stage (i).

(iii) The condensing stage - the relative increase is equal in all three locations.

(iv) There is a general but slow, asymptotic increase towards the maximum under existing conditions.

Hagerstrand's work and his models of the diffusion process are outstanding within geography. He emphasised the importance of the neighbourhood effect as it affects the decision of a potential adopter. Hagerstrand noted that

the spatial development of many diffusion processes seem to be characterised by the addition of new adopters around the original nuclei of introduction. This contagious growth has been called the neighbourhood effect and it is one of the three empirical regularities commonly noted in the diffusion process.

Mabogunje (1980) said that the diffusion of consumer innovations takes place at the level of the household and is to a large extent concerned with the acceptance of new consumption of goods and services or the adoption of new household technologies. As such its spatial diffusion often gives the impression of wave propagation or the expansion of ripples from a given source. By contrast, the diffusion of entrepreneural innovations tends to appear spatially as terminals of a set of spokes from a common hub, because of the rather selective nature of adoption.
The role of inter-personal face-to-face communication in the diffusion of innovations is regarded as critical. Part of the reason for this is the complexity that often goes with the adoption of even a simple innovation such as a new type of seedling. Although questions like when should it be planted, how should it be planted, how long should it stay in the soil, what is the nature of its moisture requirements, etc., can be answered in a publication, face-to-face interaction is often still necessary to cope with any reservations which a potential adopter may have.

Productive contacts resulting in the diffusion of innovations are facilitated by certain types of spatial

conformation in the human geography of a country. These according to Mabogunje include, for instance, market places and a hierarchical system of urban centres. The urban centres, apart from their role in ensuring the spatial interaction of a country, equally serve the important function of facilitating the diffusion of innovations. Of comparative significance in this regard is also the transportation network which Pottier (in Hilhorst, 1972) referred to as Development Axes. This has the effect not only of improving accessibility but also of increasing the contact and information fields of individuals. It is partly for this reason that the establishment of a transportation network has been regarded as a most important factor in the development of a country.

Spatial diffusion can thus be appreciated as a vital mechanism for keeping the momentum of development going. Its effectiveness within a region however depends on the national network of social communication. Anything which broadens the information field of an individual promotes social communication. This includes, for instance, schools and voluntary organizations. Spatial diffusion studies however revealed the existence in every community or area of resistance or actual barriers to the spread of specific types of innovations. Resistance according to Mabogunje (1980) is often the product of social attributes which make it difficult for potential adopters to appraise correctly the value or importance of an innovation. Such attributes can be educational, religious, ethnic, class or

income group. Resistance however, can be broken under the influence of persistent communication. Barriers to the spatial diffusion of innovations need not be limited only to those of social origins. Physical features such as mountains, deserts and large bodies of water, to the extent that they greatly limit interpersonal contacts among people, often act as veritable barriers to the spatial diffusion process. Mabogunje however pointed out that resistance and barriers should not be thought of only in negative terms since spatial diffusion in itself is not always a neutral process. Just as innovations may be beneficial when they are diffused into an area when the time and condition are right and appropriate, so they may have adverse consequences in an area and a society if these requirements are not met.

From the foregoing discussion, it is evident that innovation diffusion has both social and spatial implications in agricultural development which need to be improved for the benefit of the producers and consumers. The improvements can only be made if the problems encountered in trying to disseminate improved techniques of cultivation to the farmers are known, before appropriate plans can be made on how to tackle the problems.

CHAPTER THREE

THE STUDY AREAS

3.1 Location and Physical Characteristics

The two areas under study are Funtua and Jema'a Local Government Areas of Kaduna State (Fig. 1.1). Though they are found within the guinea savanna belt, they are still found to exhibit variable physical and social characteristics, and as such, each area will be treated separately for a better understanding of its characteristics.

3.1.1. Funtua Local Government Area

Funtua is located on the Hausa plains at an altitude of between 600 - 900m above sea level. The area comprises three districts which are Maska, Bakori and Faskari, each district headed by a Project Development Officer in the Kaduna State Agricultural Development Project organization.

Annual rainfall is of the order of 1,100mm with a 75% probability of obtaining 1000mm (Ukpabio, 1978). Rainfall is confined entirely to 6 months, April through October. Between October and March, there is virtually no rain. This divides the rainland farming year into two clear seasons, a farming season and an off-season. The amount of rainfall and the duration of the rainy season constitute major constraints in increasing agricultural productivity between April and September. The regime and probabilities of rainfall are

well suited for a range of annual crops. Occasionally, the rains are very erratic in distribution leading to drought years as occurred in 1973. Thus rainfall becomes a single major climatic factor limiting crop growth and agricultural production in the area.

Given the latitudinal position of the area, temperatures are high throughout the year and there is no problem of insufficiency of heat for plant growth. This however means a high rate of evaporation and need for irrigation water where possible for extended period of cultivation.

Between October and March, the prevailing winds are North East Trade Winds (Harmattan) which usually are hot and dry, aggravating the rainless period. April to September is dominated by moisture laden South West Trade Winds from the ocean which bring the rain during this period.

The vegetation consists of low guinea savanna grassland with a scatter of shade trees including baobab, silk cotton and shea butter. The usual crops are expectedly those suited to this vegetation background; guinea corn, millet, cotton, sugar cane, maize etc.

The area according to Ukpabio (1978) is underlain by rocks of the basement complex which is predominantly granite. The land form is gently undulating at an altitude of 600-700m above sea-level. Many small ephemeral streams occur throughout the area radiating from inconspicuous watersheds.

The soils have well developed sub-soil horizons containing some 30% clay. They become easily water-logged during the rainy season but dry up and crack during the dry season. They are weakly acid with a pH in the range of 5.5. to 6.5 and are deficient in available Nitrogen particularly after prolonged cropping. Application of manure or chemical fertilizers becomes crucial to high crop yields.

There are few perennial streams in the area and ground water supplies are severely limited by the presence of impervious underlying basement complex. With increasing pressure of population and farming activities, the watersheds are exposed and the flow period of streams diminishes markedly. Wells commonly fail during the dry months leading to prolonged water shortages for humans and livestock. However the topography according to Ukpabio (1978) is such that the water table is quite near the surface and construction of small reservoirs appears a practicable solution to the water problem. This fact is the basis for the F.A.D.P.'s dams construction.

3.1.2 Jema'a Local Government Area

The second area under study is Jema'a Local Government Area of Kaduna State. This is located in the southern part of the state (Fig. 1.1). The main relief feature in the area is the Attakar-Kagoro hill which is an extension of the Jos Plateau. The area lies within the guinea savanna like in the case of Funtua, but in the middle belt of the country.

Just like any other area in the middle belt, Jema'a area is characterised by two seasons. The dry season starts from October and ends in March. This season is characterised by the tropical-continental winds generally known as the harmattan winds. However the harmattan in this area are not as severe as in the northern parts of the state. These winds are very important because they help in drying the crops preparing them for harvesting. The wet season starts in March and ends in October. The location of the area near the hill gives its characteristic orographic rain especially in Kagoro, Moro'a and Godogodo districts. The average rainfall ranges from 1397mm to 1551mm annually with effective rainy days of 130 to 150 days (Walter, 1967). Rainfall is at its peak in July and August corresponding with the time that farm work is at its peak. In fact during these months other activities come almost to a stop because farmers are usually very busy with their planting at this time.

Temperatures are generally high because of the latitudinal location and are favourable for plant growth because the potential rates of photosynthesis are generally high.

The vegetation growing in an area reflects the sum total of radiation, moisture, soil characteristics and temperature of the area. It also suggests the types of crops that could be grown in the area. In Jema'a area, the vegetation is secondary in nature because there has been much human interference with the primary vegetation

due to different activities. The vegetation consists of tall trees scattered all over the place. These trees have thick and corky barks which make them resistant to the annual fires. There are also tall grasses which are subjected to fire annually. However, pockets of the primary vegetation can still be seen in some areas, especially near river banks and also at the foot of the hill.

The soils are ferrugineous tropical soils. These soils are dry and dusty in the dry season, but muddy and sticky in the rainy season. The muddy soils retain a lot of water thereby making movement difficult for motorists especially on the laterite roads that are not well constructed. The ferrugineous soils are termed as soils of medium productivity because they are highly variable in moisture content, organic matter content, depth and general fertility (Agboola, 1979).

There are numerous rivers found in this area, which include River Wonderful, River Kajim and the Mada River. There are also other small streams some of which are seasonal.

3.2 Population and settlement Organization

3.2.1 Funtua Local Government Area

The Funtua area comprises the three districts of Bakori, Faskari and Maska. Comparatively, it is a densely populated area with an average density of about 100 persons per sq. km (Mabogunje and Gana 1981).

Most of the population in the area are sedentary Hausa farmers with a sprinkling of nomadic Fulani. Historically, the area was a frontier region between

the ancient emirates of Katsina and Zaria. As such it was until recently occupied largely by non-islamic Hausa known as the Maguzawa. Studies of Maguzawa farmers in this and other areas show that on the whole, they are hard-working, resourceful and innovative. Last (1980) noted that the Maguzawa have always been recognised as good farmers, good family men and good fighters. They have maintained not only a separateness over centuries, but also a successful economy which is now richer than that of their more integrated neighbours despite the heavier taxation imposed on them. Generally the Maguzawa have tended to believe that the less they saw of government the better off they are. Indeed in the folk tradition, the "good old days" were located in the 1910s and 1920s, that is between the dangerous days of tribal warfare and the recent period of encroaching big government, a brief spell when new lands were being opened up in the frontier area.

However, as Last also points out, their isolationist rationale did not mean that they resisted all innovations, because agriculturally they had adopted oxen and the ox-plough and they are experimenting with new seeds, etc. They also teach each other literacy and keep modern drugs. Many of the men have travelled, less it seems for work than for exploring the big towns and they bring back new ideas and new skills. Their readiness to innovate is an important factor in their economic success.

Like other Hausa groups the inhabitants of Funtua area are settled in villages often consisting of a number of residential clusters which are separated from each other and come under the jurisdiction of a village head. The village head usually lives in the main residential cluster sometimes referred to as the central village, while outlying clusters are referred to as ungwoyi translated variously as hamlets or wards. The central village may itself be divided into ungwoyi in the sense of wards. At any rate, in each residential cluster are a number of compounds each of which is usually surrounded by a wall or fence and often has only one entrance.

3.2.2. Jema'a Local Government Area

Jema'a Local Government Area comprises 9 districts, . . . The population of the area is made up of 6 major ethnic groups: Moro'a, Kagoma, Kagoro, Ninzam, Kafanchan and Jaba, with other smaller groups. The demarcation of the districts which is either by design or accident is in such a way that they are made up of each major ethnic group.

Like in the Funtua area, the inhabitants live in nucleated or dispersed settlements and still come under the jurisdiction of a village head who lives in a settlement central to the others. In each settlement the compounds (whether extended or nuclear) are built without any wall or fence. Indigenes of this area are mostly Christians with a few still worshi ping traditional gods.

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3.3 Labour Organization

It is important in the Funtua area to distinguish between three units of social organization, namely sassa, iyali, and the gandu (Ukpabio, op. cit.). The iyali refers to an individual family comprising a man, his wife or wives and his dependent children. Sassa defines the physical residential unit or compounds usually partitioned off by fences to house not only the iyali of the compound head, but also those of his adult sons or adult male relatives living with him. Gandu refers to work unit, that is, a unit of the domestic economy with common production and consumption of food, a single head, a common pot and common granary and farm. The gandu is thus something of a family cooperative; sometimes involving a father and his sons and their families (paternal gandu), brothers with their families (fraternal gandu) or sons with their male uncles and their families. In the gandu system labour is usually contributed predominantly by adult males between the age of 15 and 64. The role of women in agricultural activities is greatly restricted often involving not more than helping with harvesting crops. Children between the ages of 7 and 14 also help with agricultural work although the expansion of educational facilities in the area has reduced their contribution to the labour requirement.

Labour organization in Jema'a area is similar to what is obtained in Funtua with a majority of people being self-employed farmers who produce crops mainly for their

own consumption. However, some farmers in the area have now realized the importance of producing surplus so that they can sell to obtain some cash. The production system is done mainly by using simple tools and this method of cultivation has limited the products' output because of its inefficiency.

The labour used on the rural farms is mainly human. Families cultivate their farms individually or on communal basis. Because the size of the family determines how much production is done, polygamy was greatly practised in the past. In fact the number of wives and children that a man had determined how great and important one was in the society. This practice has seriously declined because the indigenes took to christianity quickly and gave up polygamy thereby leading to a decline in the communal type of labour. Women in Jema'a area, unlike in the case of Funtua, contribute a lot in the production system. In fact, in some instances women are more involved in the cultivation, weeding and harvesting than the men.

There is now a decline in the importance of gandu in the study areas. Table 3.1 compares the types of labour used in agricultural production among the sampled villages classified according to degree of accessibility.

Table 3.1 Type of labour used in agricultural production according to degree of accessibility

Labour Used	No. of respondents using stated labour							
	Cat. I		Cat. II		Cat. III		Total	
	No.	%	No.	%	No.	%	No.	%
Family	56	93	70	70	16	10	142	44
hired	48	80	68	68	144	90	260	81
communal	44	73	20	20	12	9	76	24
Total no. of respondents*	60	100	100	100	160	100	320	100

* some respondents use more than one type of labour.

Source: Field Survey (1986).

In order to find out whether there is a significant difference between the three categories of villages in types of labour used, a χ^2 test was carried out.

The null hypothesis for this test is that there is no significant difference between the three categories of villages in types of labour used. Alternative hypothesis is that there is a significant difference between the three categories of villages in types of labour used.

Calculated Chi-square	Critical value (P<0.001)	Degrees of freedom	Significance level
115.6	18.46	4	0.001

H_0 is rejected at 0.001 significance level. The χ^2 shows that there is a significant difference between the three categories of villages in types of labour used.

Farmers in villages in category I use family labour more than those in any other category because most of them are still producing at the subsistence level. Communal labour is on the decline as one moves from the remote villages to the very accessible category because of the access to wealth and economic opportunities which has made it difficult for the spirit of communal solidarity to be sustained. Hired labour is commonly used in villages of all categories because most of the farmers are now trying to make up for their shortages, especially in category III where most farmers are found to have other occupations apart from farming. It is interesting to note that category I used more of the three types of labour than any other category. This is because farmers at this level are now aware of improved means of production like use of tractor and ox-plough, but do not have access to them. This has resulted in farmers employing all means of labour available and accessible to them to increase their production. On the whole hired labour tends to be more used because of the growing impact of the money economy, on the basis of which people prefer to offer labour for wages, and also due to the higher labour efficiency associated with hired labour.

3.4 Land Tenure and Land Holdings

It is still traditional in the villages to regard land as belonging to the Emir whose representative at the village level is the village head. The latter distributes the land among farming families and authorises and witnesses certain land transactions. Because land is regarded as owned by the Emir, individuals can only have only right of use (usufructuary rights) over the land (Abalu et al. 1979). In theory, this may be assumed as inhibiting them from engaging seriously in the betterment of the land. In practice, however, there is little fear of losing land on which usufructuary right has been exercised for a considerable number of years.

The inheritance law is not different from the customary law of land usage, where land owned by a deceased person is divided by all his male heirs and which has resulted in fragmentation of holdings. It is not surprising then for farmers to have their farmlands in two or more plots scattered all over the village and intermixed with those of others.

It is possible to identify 5 major ways in which rights to farmland can be acquired within the study areas:

(a) Inheritance (gado) whereby upon the death of the head of a family and sometimes even before his death, the land is divided among his sons and sometimes his daughters.

(b) Gift and allocation (kyauta) whereby a land holder may give a piece of land to relatives or close friends. Such gift land can be inherited by the descendant of the original recipient of the land. A variant of gift land is allocated land. In this case the village head allocates an abandoned farm or piece of bush to a new-comer or to a local inhabitant who requires more farmland.

(c) Sale (sayarwa) whereby there is an outright transfer of land for cash. However, it is generally recognised that it is only the usufructuary right to the land that has been sold and not the land itself.

(d) Pledge (jingina) whereby the right to use a piece of land is passed to another individual in return for a money loan. In such cases the amount paid is usually less than the value of the land. Usually there are not stated terms concerning repayment, and the creditor farms the land until the loan is repaid.

(e) Loan (aro) whereby the land of an individual is farmed by another individual on a year to year basis in return for a small rental paid at the time of harvest in cash or in kind. However, the agreement may be for two to three years.

Traditionally within the study areas, land acquired through inheritance is most common, followed by holdings

acquired through gift. However, holdings acquired through sale, pledge or loan are of recent origin reflecting the increasing monetization of the economy, and this has resulted in more fragmentation of farmlands.

In the Funtua area, the number and total area of farmlands available to individual farmers tend to be small. From table 3.2, 90·1% of farmers in the area were in 1979-80 small scale farmers with average farm holdings of about 4 hectares. The mixed farmers who occupy an intermediate position between the small and large scale farmers represent a special category in that they are some farmers who have adopted the use of ox-ploughs in their farming and who in consequence need more land for rearing animals which have become an integral part of their interprise. They have an average size of land 8 hectares. The large scale farmers who constitute only 0·6% of the total farming population have an average land holding of 48.6 hectares.

Table 3.2: Number of farmers in F.A.D.P. Area by categories of farm size 1979 - 80

Category	Total no. of farmers	%	Average holdings (ha)	Total area (ha)
Small farmers	77,500	90·1	4	313,765
Mixed farmers	8,000	9.3	8	64,777
Large farmers	500	0·6	48.6	24,292
Total	86,000	100		402,734

Source: K.A.D.P. Manager (1986).

Cultivated land in the area is usually categorised into two types. There is the gona or upland fields which can only be cultivated in the rainy season. There is also the fadama or lowland fields near streams where the water table is close to the surface and the general configuration of the valley is conducive to cultivation. The fadama supports such intensive crops such as sugarcane, rice and vegetables while the rainfed gona supports extensive crops such as guinea corn, millet, cotton, etc. Within the Funtua area, nearly 70% of the land is under rainfed arable cultivation (Ukpabio 1978) where 100% of the respondents indicated that they farm on this part of land. Also from the present survey, 5% of the farmers indicated they have fadamas which they cultivate during the dry season.

The situation in Jema'a area only differs a little from what is obtained in Funtua in that the former has a third category of cultivable land called the settled area. This land is found around the compounds where crops like maize, vegetables and cocoyam are grown. These settled areas are fertilized with compound manure and only little use of chemical fertilizer is made for proper growth and yields of crops.

Cropping patterns in the area are characterised traditionally by mixed cropping, whereby different crops are planted together on the same plot. This is not to imply that there are no pure stands of particular crops.

Indeed the major crops are often grown in this fashion but the impression of a mixed profusion of crops is very strong when one visits farmers in the area. Table 3.3 shows the cropping pattern in the Funtua area by districts according to a survey carried out by the F.A.D.P. in 1977.

Table 3.3: Cropping Pattern in Funtua area by Districts 1977

Cropping Pattern	% of cropped land		
	Bakori	Faskari	Funtua
Guinea Corn	27.3	22.8	25.2
Guinea Corn/Millet	12.0	15.7	14.6
Millet	3.3	-	2.0
Groundnuts/G. Corn	7.1	5.8	4.5
Cotton	6.1	12.6	9.0
Cotton/Millet	2.5	6.0	5.8
Cotton/Cowpea	-	3.6	2.8
Maize	-	-	2.5
Cotton/Maize	2.8	2.4	-
Maize/G. nuts	-	8.5	2.8
Others	39.0	22.6	30.8

Source: Adapted from Ukpabio (1978)

Table 3.3 emphasises the dominance of guinea corn in the cropping pattern especially for subsistence crops. Cotton is traditionally the major export crop and occupies at least 5% of crop area in pure stands in some districts.

It is mixed with millet, guinea corn, maize or cowpeas in significant proportions. Maize cultivation is a very interesting feature in the area. Maize is not traditionally a crop of this region but it is already becoming important as a mono-cultivated crop in the area. The category 'others' refers to areas grown exclusively in such crops as rice, sugarcane, pepper, groundnuts, etc.

A study of the land ownership in the two areas has shown two types of land holdings. The first is family holdings. This is a situation where large families stay in the same compound and land is collectively owned but controlled by the head of the family. This system of holding is breaking down now with the breaking up of large families to smaller ones with only a man, his wife or wives and children. This leads us to the other type of land holding known as individual holding which came about with the breaking up of the extended family system. In this case, a father owns the land which is shared among his sons on his death and his sons hand it over to their own sons. It is this system of inheritance that has resulted in the plots becoming smaller with succeeding generations.

Bush fallowing was practiced in the past as a measure to allow soil to regain its fertility, but due to population increase, this practice has been stopped. Rather, farmers use other means to improve soil fertility including the use of compound and animal manure, and use of chemical fertilizers.

The size of land devoted to the cultivation of various crops depends on how important a crop is to the society. Crops like millet, guinea corn and maize have more land devoted to them because of their importance to the people in the areas.

Another factor that is an important input to agriculture is capital. But since this is an agricultural production based on relatively low technology, very little capital is invested except in very few cases where a very low percentage of farmers in very accessible villages use tractors for cultivation. Capital is used for the purchase of farm implements like hoes, axes, cutlasses, knives, etc, and inputs like fertilizers, chemicals and seeds.

3.5 Socio-Economic Development

The Funtua area is part of the broad belt which during the colonial period concentrated on export cotton production. This initial impetus for this development according to Mabogunje and Gana (1981) was twofold. First was the extension of the railway line from Zaria to Kaura Namoda between 1911 and 1929 which cuts across Funtua. Second was the decision by the British Cotton Growing Association (B.C.G.A.) in 1925 to transfer their ginneries from Abeokuta and Eruwa Road in the South to Gusau and Dutsin-Ma in the North, close to Funtua.

The shift in the centre of activity of the B.C.G.A. was further marked by the tremendous emphasis given to the introduction and dissemination of a new variety of cotton calculated to replace the traditional one. This variety (Allen variety) answered equally well the needs of textile industry and the requirement of the overseas market. It also fitted well with local farming practices, being planted after the main food crops and not picked until the food crops had been harvested. These were the main reasons that gave the new cotton variety the advantage to be adopted in the area.

There was also the establishment of an official cotton market by licensed buying agents. Processing of the cotton after picking was done at the ginneries operated by B.C.G.A. Seeds for planting were distributed free to farmers throughout the cotton producing area and the prohibition of production of other varieties except the Allen variety ensured the maintaining of high quality of cotton produced from this area of the country.

In 1926, a seed multiplication farm was established at Daudawa by the Empire Cotton Growing Corporation (E.C.G.C.). This organization, according to Mabogunje and Gana, worked closely with the then Nigeria Agricultural Department at Samaru and in 1947 had developed a variety of cotton seeds known as the Nigerian Allen or Samaru 26^{c} which was superior to the Allen in yield and resistance to bacterial blight. Farmers were encouraged to produce this by the intervention of the colonial government in 1948.

This they did by fixing prices for cotton and also buying from farmers regardless of their location from the railhead. Cotton evacuation roads were also constructed which facilitated the bringing of cotton to gazetted markets and to the ginneries. The result of these various efforts was that cotton production in Nigeria jumped from 6,600 tons in 1946 to over 19,000 tons in 1952 and to over 43,000 tons in 1958.

By independence (1960) the Funtua area was one of the most progressive agricultural regions of the country. The farmers were quite disposed to accepting innovations at least in terms of new seeds, provided the circumstances surrounding such innovations were judged appropriately. This export production brought to farmers in the Funtua area relatively higher income compared to those of the contemporaries in non-exporting producing areas like Jema'a area. Rather Jema'a area has concentrated on the production of food crops on a subsistence basis since the area is not lucky to have fallen within any region producing any of the country's export crops.

3.6 The Funtua Agricultural Development Project

Agricultural administrators in the country view the shortage of agricultural products as having its origin in the rural sector. They view the main cause of the stagnation of agricultural output as arising from the physical absence of improved inputs and in many cases

from the absence of price incentives.

The Kaduna State Government with the support of the Federal Government and the assistance of the World Bank has attempted to overcome this problem by targeting the rural poor for integration into the political and economic life of rest of the state. At the heart of the integrated strategy being pursued is a "technology first" approach. In 1975, some of the richest farmlands in the state in Funtua area were devoted to the state's pioneer integrated rural development pilot project, which was later extended to cover the entire state.

The project, according to Abalu et al.(op. cit.). appeared to have been founded on a simple phiolosophy of grafting onto the existing socio-economic system a basic infrastructure for a more effective delivery of agricultural inputs for the rural population. This was with a view to raising productivity and improving the quality of rural life. Instead of radically transforming the existing modes of production, the project was planned to provide essential services and inputs to the existing system of production.

3.6.1. The Basic Design of the Project

This summary report has been extracted from the F.A.D.P.'s various quarterly reports and other relevant documents on the F.A.D.P.

In consequence, the most important technological innovations brought into the Funtua area by the project

were the adoption of a spatial approach to planning a delivery system of services for rural development. This approach paid special attention to the spatial distribution of settlements within the project area and organised them in terms of a hierarchy of central places for ensuring efficient delivery of services to the numerous farmers within the area. An important aspect of the F.A.D.P. was thus the establishment of a network of 77 Farm Service Centres (F.S.C.), located at central villages and meant to serve as the focal points for the distribution of farming inputs. Extension services were also to be made available at the centres. Above the level of farm service centres were five District Development Centres with development officers charged with the responsibility of coordinating the activities of staff at the level of Farm Service Centres. At the apex was the Project Headquarters at Funtua with various sections. This hierarchical organization was aimed at efficient management and effective provision of essential services to farmers.

Another critical component of the project was the design and construction of a network of low cost rural roads, dams, and tapkis (ponds) with associated soil conservation measures. It was hoped that the network of 1,500km of roads would permit the efficient evacuation of farm produce, the timely supply of farm inputs, the effective movement of project staff and improved access to farms and hamlets, and also facilitate the

expansion of other government programmes notably health and education, into areas which were inaccessible.

With regard to the earth dams, some small and medium size earth dams

were to be built with some tapkis. These were both to supply water for human and livestock consumption in addition to being used for irrigation of village vegetable production where possible.

Another major component of the design comprised:-

1. The development and expansion of seed multiplication centres for the provision of adequate supplies of improved and high-yielding varieties of seeds.
2. The provision of appropriate labour-saving devices including land preparation machinery, ox-ploughs, tractors, spraying machinery, fertilizers and insecticides.
3. The provision of effective extension services to facilitate the diffusion of innovations.
4. The provision of adequate marketing facilities.
5. The provision of short-term credit to farmers for the purchase of inputs and equipment.

With regard to seed multiplication, the idea was to improve the existing centre at Daudawa and expand and develop the Malumfashi seed farm. These two centres in association with nearby large farmers were expected to provide the project and other state farmers with improved

seeds, act as demonstration and research centres and offer practical training in farm management. It was reckoned that during the five-year project period some 4,000 tons of improved seeds would be made available to the farmers. Along with these were also to be provided some 56,000 tonnes of fertilizers, 2,000 tonnes of insecticides, 47,000 tonnes of ultra low volume insecticide sprayers, 10,000 ox-ploughs, 10,000 ox-carts, and 100 tractors and associated implements. The intention was to sell these inputs and implements to farmers for cash or credit at the Farm Service Centres.

A major emphasis was placed in the Project on the expansion and intensification of extension services to the farmers. The plan was to increase the ratio of to extension personnel to farmers from the current 1:2440 to 1:240. This involved raising the numbers of extension agents from 41 to 410. The extension personnel would include beside basic extension agents, individuals specialized in livestock husbandry, seed multiplication, commercial farm management, farming training and farm equipment. Some 260 other personnel of various grades were to be employed to provide credit and marketing services. The credit service was to operate as a project controlled credit revolving fund with facilities to provide other services concentrated on improving marketing liaison, quality control, price information and produce weighing, apart from controlling traders.

Though the Project's activities were well organised in a hierarchical manner, the farming families were not organised within an institutional way to facilitate a two-way flow of information and interaction with the project management. Rather each family was to be reached individually through extension workers and the extent of participation in the project was determined by the amount of services each individual was able to pay for.

3.6.2 Project Production Performance

The major success of the F.A.D.P. was expected to be measured in terms of remarkable increase both in productivity levels and in the volume of total productivity where it concentrated on five major crops, namely: cotton, sorghum, maize, groundnuts and cowpeas. Table 3.4 shows the magnitude of productivity gains anticipated by the project in respect to the five crops. For maize, yield per hectare was expected to be more than double while for sorghum increase of over 40% was anticipated. Total production was expected to grow more than 13 times in the case of maize and at least 3 times and 2½ times in the case of cowpeas and cotton respectively. The unimpressive increase with regard to sorghum was to be due to a sharp decrease of nearly 25% in the hectarage devoted to it.

Table 3.4: Planned Productivity Gains in the F.A.D.P area before and after Development

Crop	Before development			After development		
	Area(ha)	Average yields Kg/ha	Total Prod. ('000 tonnes)	Area(ha)	Aver. yields Kg/ha	Total Prod. ('000 tonnes)
Cotton seed	90,500	270	24	99,056	600	60
Guinea corn	120,000	750	90	91,200	1,060	96
Maize	5,000	900	5	32,500	2,000	66
G. nuts	32,500	480	16	35,250	740	24
Cowpea	3,800	200	1	5,000	670	3

Source: Adapted from Mabogunje and Gana (1981)

The innovations in agricultural practices that were to bring about such dramatic increase in productivity were many and varied. For instance, to produce maize efficiently, the adoption of a high yield, short season maize variety was to be crucial. Other crops require equally significant modifications to ensure increase in productivity.

A significant proportion of the targeted task was accomplished. Of the 77 proposed F.S.C. some 71 were actually built along with 5 District Development Centres. Of the 1500km of low cost rural roads planned only 521km were constructed, although all roads leading to the service centres were surfaced. Out of 85 dams

planned only 43 were completed. It was admitted that since the location of the F.S.C. was decided upon without prior consultation with the farming families, some of the centres turned out not to have been as useful as expected. In the evaluation report of the last quarter of the Projedt, it was noted that if this had been done and the farmers were also involved in the decision regarding which roads and dams to construct, they would have felt that these structures belonged to them, would have participated very happily in their construction under the guidance of technical experts, and would thereby have helped in reducing the cost.

The number of field extension workers actually employed came on annual average to 291, instead of 420. The management of the project nonetheless placed considerable emphasis on extension services. This was organised as a major department with the following 5 sections:

(a) General Extension Service Unit
(b) Demonstration Unit
(c) Farm management Training Unit
(d) Livestock Services Unit
(e) Mobile In-service Training Unit.

In order to effectively reach the farmers the extension services were structured around the 5 Development Areas each of which have a Development Officer in charge. The Development Officers were supposed to supervise the activities of Agricultural Assistants located at the level

of F.S.C. Below the agricultural assistants were the agricultural instructors who were in direct contact with farming households at the village and ungwa levels.

Farmers were categorised into 3 groups; large scale or farm management farmers, progressive farmers and traditional farmers. The management decided to concentrate extension attention on the progressive farmers. The progressive farmers represented only about 22.7% of total farmers in the project area, and it was on this minority of farmers that were concentrated over 60% of extension workers visits (Zone II Project Manager evaluation report, 1986). These included all visits for advisory purposes, registration and recording of progressive farmers, acreage measurement and demonstration work. The expectation was that through the progressive farmers, improved farming methods would spread to the rest of the rural population in a trickle-down fashion.

The Project however also provided radio programmes on improved farming practices and encouraged the farmers to listen to these.

In spite of the intensity of extension work the Project recognised that farmers in the area were still averse to risk-taking and were not prepared to go in for a more reliable method of cultivation (double cropping or more) than sole cropping. Most farmers continue to produce more for subsistence rather than profit maximization. They found it more realistic to minimise risk through maintaining a cropping system that

can ensure their survival over seasons of poor harvest or other catastrophes like locust and outbreak of diseases. This has meant serious difficulty in getting the farmers to accept the system of crop rotation and has contributed to the limited output obtained from most farmers.

However, greater success was recorded with large-scale farmers and the category regarded as "advanced farmers". The Project noted that it had achieved substantial improvement in the standard of farming practised by these farmers and that a number of them were already developing viable commercial farms.

The Project also undertook to provide livestock extension services. These concentrated on advising farmers on fodder conservation, feed and care of workbulls, tick and worm control in cattle and improved poultry husbandry. A livestock demonstration farm was established at Layin Minista to which livestock farmers and herdsmen were frequently brought. Achievement here has been quite modest owing largely to limited resources of both staff and funds.

The provision of credit to farmers was also made by the project for the purchase of farm inputs (especially fertilizer) and implements. Interest rates were based on the category of the farmer or the type of input he requires the loan for. Recoveries of credit were initially very difficult especially as it was customary for most

farmers to enter into various financial commitments immediately after the harvest. Indeed credit was stopped in 1977 and effort concentrated on recovery with the assistance of traditional leaders at the levels of the rural community enlisted. However, credit for large scale farmers continued through the commercial banks with the support of farm plans provided by the Project.

From the preceding discussion it is clear that the F.A.D.P. has succeeded in achieving some of its goals and that has motivated the Kaduna State Government to extend the project to now cover the entire State. The Project, now called the Kaduna State Agricultural Development Project (K.S.A.D.P.) with its headquarters at Kaduna, has been divided into four zones with each zone comprising three or four Local Government Areas. Funtua Local Government Area is in Zone II while Jema'a Local Government Area is in Zone IV with their headquarters in Funtua and Samaru Kataf respectively. Because of the Project's shorter lifespan in Jema'a area, most of the villages here fall under category I because of physical barriers like hills, rivers, vegetation, etc. This has resulted in many farmers not having access to innovations.

CHAPTER FOUR

SOCIO-SPATIAL VARIATIONS IN ADOPTION OF INNOVATIONS.

4.1 Communication Channels and Access to Information on the Innovations.

The first objective of this study is to examine the types and effectiveness of various communication channels and sources of information available to the farmers on the four selected innovations (tractor services, use of fertilizers, use of ox-ploughs and use of improved maize varieties).

4.1.1 Awareness of Innovations

Awareness of an innovation is considered the first step in the adoption of innovations. Before an innovation is adopted, there must be first the information about it, which makes awareness very crucial in the adoption of any innovation. Farmers in the study areas were presented with the chosen four innovations and asked to indicate which they had heard about. Table 4.1 shows the extent of this awareness as indicated by the farmers in the three categories of villages.

Table 4.1: Awareness of Agricultural Innovations in the three Categories of Villages.

Village Category	No. of farmers in sample	No. of respondents aware of each Innovation							
		Tractor		Ox-plough		Improved Maize		Fertilizer	
		No.	%	No.	%	No.	%	No.	%
I	60	2	3	0	0	50	83	60	100
II	100	75	75	75	75	100	100	100	100
III	160	160	100	130	81	160	100	160	100

Source: Field Survey (1986).

The findings presented in Table 4.1 show that farmers in Category III villages have a higher awareness level of the selected four innovations more than villages of category II and I. This is probably related to the availability of various sources of information in villages of category III, especially the extension workers who play an effective role in disseminating agricultural information. The extension workers are, however, fewer in the category II villages and completely absent in category I villages. Also other forms of economic infrastructure like Farm Service Centres (F.S.C.) are well distributed in villages of category III, which also enhances the level of awareness of farmers.

There is 100% awareness of fertilizer usage in all the categories of villages. This reflects the simplicity in the use of fertilizer and also the fact that it can be distributed easily even to the remote villages.

The next innovation in terms of level of awareness, second to fertilizer, is the improved maize varieties. Tractor usage is known to all farmers in category III, which is clearly related to the accessibility factor, while only few farmers in category I are aware of the tractor usage because it has not been introduced in these villages. Also the use of ox-plough is not known in category I, perhaps because of the soil characteristics which have inhibited its being introduced into this category of villages. This suggests that accessibility plays a role in enhancing the awareness level of farmers on various innovations, which is termed the first stage in the adoption process.

4.1.2 Sources of Information Used.

The diffusion - adoption theory proposes the diffusion of innovations through certain channels to individuals, leading to either the adoption or rejection of the innovations. This makes the channels of information flow very critical factors in influencing the awareness and adoption of innovations. Those farmers who indicated awareness of the innovations were asked to indicate the various sources of information through which they first heard of each of the selected innovations. Tables 4.2, 4.3, 4.4 and 4.5 present a summary of the sources of information through which the respondents first became aware of each of the innovations.

Table 4.2: Sources of Information for First Awareness of Tractor Use.

Source of Information	Number of Responses					
	Category I		Category II		Category III	
	No.	%	No	%	No.	%
Extension Workers	-	-	20	27	54	34
Friends	1	50	2	3	6	4
Neighbours	-	-	6	8	10	6
Radio	1	50	-	-	-	-
Saw it myself	-	-	47	62	90	56
Total No. of Responses	2	100	75	100	160	100

Source: Field Survey (1986).

Table 4.2 shows that the most important first sources of information on tractor use among farmers in categories II and III are through first hand observation and through extension workers. Because of the availability of access roads, most farmers in these categories of villages have seen tractors in operation. Extension workers are also found in these villages because of the presence of roads and they play an important role in making farmers aware of the use of tractors. Where the innovation has been introduced, it is possible for other farmers to see it being used and that stands as a very important source of information for first

awareness in villages of categories II and III. Other source of information used here are neighbours in the villages and friends who may have come from other places and might have used a tractor or saw it being used and went to tell their friend or neighbour. For villages of category I, the only sources mentioned were friend and radio.

Table 4.3: Sources of Information for First Awareness of Improved Maize Varieties.

Source of Information	Number of Responses					
	Category I		Category II		Category III	
	No	%	No	%	No	%
Extension worker	-	-	72	72	160	100
Friends	15	30	4	4	-	-
Neighbour	21	42	10	10	-	-
Radio	-	-	10	10	-	-
Saw it myself	5	10	4	4	-	-
Market	6	12	-	-	-	-
Compound head	3	6	-	-	-	-
Total No. of responses	50	100	100	100	160	100

Source - Field Survey (1986).

Table 4.3 shows that extension workers rank higher than any other source in disseminating information about improved maize varieties in villages of categories II and III.

This shows the importance of interpersonal face-to-face contact where the extension worker can demonstrate to the farmers and also allow the farmers to ask any questions they may want to ask. For villages of category I, neighbours are the most common source of information on improved maize varieties, stressing the importance of the neighbourhood effect. Other sources of information are also used which are less popular in disseminating information about improved maize varieties.

Various sources of information were also presented by the respondents on the use of fertilizer, which are presented in Table 4.4.

Table 4.4: Sources of Information for First Awareness of Use of Fertilizer

Source of Information	Number of "esponses					
	Category I		Category II		Category III	
	No.	%	No	%	No	%
Extension workers	-	-	40	40	96	60
Friends	16	27	8	8	-	-
Neighbours	24	40	6	6	-	-
Church	5	8	-	-	-	-
Agric. show	-	-	4	4	-	-
Radio	10	17	42	42	64	40
Market	5	8	-	-	-	-
Total No. of respondents	60	100	100	100	160	100

Source - Field Survey (1986)

Data presented in table 4.4 indicated only two sources of information for villages in category III. They are extension workers (60% of respondents) and radio (40%). This shows that the availability of official sources of information is important in the highly accessible villages. This situation is also evident in villages of category II where 42% and 40% of respondents indicated radio and extension workers respectively to be their sources of information. Villages in category I have neighbours as the most important source of inform tion followed by friends. Other sources of information include church and market for villages of category I. This shows how social gatherings of any form serve as sources of information on new farm practices.

Sources of information for first awareness of use of ox-ploughs are presented in Table 4.5.

Table 4.5: Sources of Information for First Awareness of Use of Ox-ploughs.

Source of information	Number of responses					
	Category I		Category II		Category III	
	No	%	No	%	No	%
Extension workers	-	-	30	40	64	49
Friends	-	-	2	3	4	3
Neighbours	-	-	3	4	20	15
Saw it myself	-	-	5	7	-	-
Compound head	-	-	35	47	42	33
Total no. of responses	00	00	75	100	130	100

Source - Field Survey (1986)

Data presented in Table 4.5 show that villages under category I are not aware of the use of ox-plough because it has not been introduced into the area. Extension workers and compound heads rank high as sources of information on the use of the ox-plough in villages of categories II and III.

4.2 Adoption behaviour of Farmers.

Awareness of an innovation does not necessarily lead to its adoption. Rather a farmer is subjected to a mental process which enables him to either reject or accept the innovation he is aware of. In order to determine farmers' adoption behaviour, farmers were asked to indicate any of the selected innovations they had adopted. The results obtained for each innovation in the three categories of villages are presented in table 4.6.

Table 4.6: Adoption behaviour of Farmers for each Innovation

Category of villages	Total No. of respondents	No. of Adopters and non-adopters							
		Tractor		Ox-plough		Improved Maize		Fertilizer	
		A	N	A	N	A	N	A	N
I	60	0	60	0	60	27	33	60	0
II	100	24	76	60	40	74	26	100	0
III	160	52	108	96	64	127	33	160	0
Totals	320	76	244	156	164	228	92	320	0

A - Adopters

N - Non-adopters

Source - Field Survey (1986)

Fertilizer has been adopted by all the respondents in all three categories of villages. This is because it is a simple and fairly cheap innovation to adopt. Adoption of improved maize varieties is also high with 45%, 74% and 79% adopters for villages of category I, II and III respectively. This also reflects the ease of acquiring this innovation. The ox-plough has been adopted by 60% of respondents in each of categories II and III villages, but has not been adopted at all in villages of category I. The least adopted innovation among the selected four is the tractor which has only 24% and 33% adopters for villages of categories II and III respectively. This could be due to the problems associated with the use of tractors, especially their high cost and high hiring charges. No farmer has adopted the use of tractor in category I villages, which is probably related to the problem of inaccessibility.

Fertilizer has been adopted by all respondents, and as such it is not included in the subsequent analysis in this chapter. Tractor usage, use of ox-ploughs and use of improved maize varieties are the three innovations considered in the analysis. In the light of this, an "adopter" is considered to be a farmer who had adopted one or more of these three innovations, while a "non-adopter" is a farmer who had not adopted any of these innovations. The adoption behaviour of these innovations in the three village categories is presented in table 4.7.

Table 4.7: Adoption behaviour of all Innovations (except fertilizer) in the three village categories.

Category of villages	Adopters		Non-adopters		Total No. of respondents
	No.	%	No.	%	
I	27	45	33	55	60
II	74	74	26	26	100
III	127	79	33	21	160
Total	228	71	92	29	320

Source - Field Survey (1986).

The results presented in Table 4.7 show a decreasing trend in the percentage of adopters from villages of category III to villages of category I. Out of the total respondents, 71% are therefore adopters and 29% non-adopters.

4.3. Relationship between Adoption behaviour and Sources of Information.

Table 4.8 shows the relationship between the sources of information used by farmers and their adoption behaviour for all the innovations (except fertilizer).

Table 4.8: Sources of Information used and Farmers' Adoption behaviour (all Innovations except Fertilizer)

Source of Information	No. of farmers using source who have		Total No. of respondents using each source
	Adopted	Not adopted	
Extension worker	170	62	232
Radio	42	84	126
Friend	23	24	47
Neighbour	20	38	58
Others	21	42	63
No. of Farmers in sample*	228	92	320

*Some farmers used more than one source of information.

Others - Church, compound head, market, agricultural show, etc.

Source - Field Survey (1986).

In order to find out whether there is a significant difference between adopters and non-adopters in the sources of information they are exposed to, a Chi-square test was carried out.

Null Hypothesis: There is no significant difference between adopters and non-adopters in the sources of information to which they are exposed.

The alternative hypothesis is that there is a significant difference between adopters and non-adopters in the sources of information to which they are exposed.

Calculated Chi-square	Critical Value ($P < 0.001$)	Degrees of freedom	Significance level
74.5	18.46	4	0.001

Null hypothesis is rejected at 0.001 significance level. The Chi-square shows that there is a significant difference between adopters and non-adopters in the sources of information they are exposed to.

What emerges from this analysis is that sources of information that allow interpersonal contact are most effective in disseminating information to farmers because of the ability of the change agents to demonstrate to the farmer the message they are communicating to him. Also it allows for two way communication, where the farmer is free to ask any questions that he might not have understood. Breaking down the sources of information into official and non-official sources, one finds that official sources (extension workers, and radio) are used by 72%, 50% and 10% of respondents in villages of categories III,II and I respectively. This demonstrates how official sources of information on farm techniques are important among Nigerian farmers. The farmers have this to say on official sources of information:

"that the extension worker is well trained in agricultural practices, and as such is able to demonstrate to them how to go about their production effectively. The radio is also effective because it can disseminate information to a large audience at a time" (field survey, 1986). Because extension workers are absent in villages of category I, farmers there tend to make more use of non-official but verbal sources of information like neighbours and friends. Extension workers and neighbours thus appear to be the most effective sources of information used by farmers. This supports what Lionberger (1960) said, that even with specialized agencies to develop scientific information and deliver to farmers, farmers still rely heavily on peers for advice in their decision to adopt new farm practices. Official and interpersonal sources of information clearly both need to be encouraged and made available to farmers.

4.4 Relationship between Social Characteristics and Adoption of Innovations

The second objective of the study relates to social factors influencing the adoption of innovations. In order to examine these relationships the two factors of age and literacy have been selected.

4.4.1 Relationship between Age and Adoption of Innovations.

Age has been suggested by Ali (1977) to be negatively associated with acceptance of certain farm practices

(that is, the older one is, the less he is likely to adopt innovations). Table 4.9 shows age levels and adoption behaviour of farmers for all the innovations.

Table 4.9: Age levels and Adoption behaviour of Farmers for all Innovations (except Fertilizer)

Age level	Adoption behaviour					
	Adopters		Non-adopters		Total	
	No	%	No	%	No	%
15-29	49	21	15	16	64	20
30-55	139	61	27	29	166	52
≥56	40	18	50	54	90	28
Totals	228	100	92	100	320	100

Source: Field Survey (1986).

In order to find out whether there is a significant difference between adoption behaviour in the three age levels, a Chi-square test was carried out.

Null hypothesis: There is no significant difference between the age levels in their adoption behaviour.

$C_a$lculated χ^2	Critical Value (P< 0.001)	Degrees of freedom	Significance level
47.3	13.82	2	0.001

Chi-aquare calculated is significant at the 0.001 level, therefore the null hypothesis is rejected, meaning there is a significant difference between the age levels in their adoption behaviour.

Results in table 4.9 show that farmers within the age group ≥56 constitute the aged who are conservative and traditional in their ideas; it is not supprising that they constitute only 18% of total adopters although they comprise 28% of the total sample. 21% of all adopters are from the age group between 15 - 29 years. These are the youths who may not yet be established in farming. The largest number of farmers who constitute 61% of adopters fall within the middle age group. This group comprises members who are economically well established and as such can afford to adopt innovations, for they know the benefits involved in doing so.

4.4.2: Relationship between Literacy and Adoption of Innovations.

Education is another social characteristic that was examined to find out how it is related to the rate of adoption of innovations. For this study, ability to read and write is considered as being literate. About 87% of the total respondents claimed they can read and write, either through formal education, or through personal efforts. Table 4.10 shows literacy levels and adoption behaviour of farmers for all the innovations (except fertilizer).

Table 4.10: Literacy level and Adoption behaviour of Farmers for all Innovations (except Fertilizer)

Literacy level	Adoption behaviour					
	Adopters		Non-adopters		Total	
	No	%	No	%	No	%
Literates	190	83	88	95	278	87
Illiterates	38	17	4	5	42	13
Total	228	100	92	100	320	100

Source: Field Survey (1986).

In order to find out whether there is a significant difference between the two literacy levels in adoption behaviour, a Chi-square test was carried out.

Null hypothesis: There is no significant difference between the two literacy levels in adoption behaviour.

Calculated Chi-square	Critical Value ($P < 0.005$)	Degrees of Freedom	Significance level
8.6	7.88	1	0.005

Calculated chi-square is significant at the 0.005 level, therefore we reject the null hypothesis. This means that there is a significant difference between the two literacy levels in their adoption behaviour.

Results in table 4.10 surprisingly show that the illiterate farmers are more likely to adopt innovations than the literate farmers, contrasting with the views of Rogers et al. (1969) who discovered from their various studies that the relationship between acceptance of new farm practices and education tends to be positive with the educated farmers adopting innovations before the non-educated farmers.

Ali (1977) argues that education's contribution to innovativeness can be looked at in the communcation opportunities that become open to the farmer in form of bulletin, posters, letters, etc, that he is able to read and make him a more aware person. However, findings from this study show that the farmers do not make use of any such sources of information. Rather information on the selected innovations is disseminated to the farmers through interpersonal face-to-face contact like extension workers, friends, neighbours, compound heads, etc. Thus education does not seem to have influenced the adoption of the selected innovations in this study perhaps because of the type of the sources of information used.

4.5: Relationship between Accessibility and Innovation Adoption

According to Agboola (1977), whether we are concerned with the real components of agriculture or factors

which influence their operation, they all vary in space and are subject to spatial analysis. Spatial diffusion studies, however, reveal the existence in every community of areas of resistance or actual barriers (both social and physical) to the spread of specific types of innovations which could be broken by persistent communication. These physical barriers include features such as mountains, deserts and large bodies of water; to the extent that they greatly limit interpersonal contacts among people, these often act as variable barriers to the spatial diffusion process.

Physical accessibility is the ease with which people can reach distant but necessary services or the ability of people to reach destinations at which they carry out a given activity. If persistent communication services open up a region either physcially or socially we say that the area has become accessible.

In this section, the means of mobility used by the farmers, and also the extent of adoption of the selected innovations in the three village categories, are examined.

4.5.1: Means of Mobility Used by Farmers.

Because of differences in the level of accessibility in the three village categories, farmers employ the use of different means of mobility for movement in carrying out their activities. Tables 4.11, 4.12 and 4.13 give a summary for the means of mobility used for movement from home to farm, home to market and home to nearest Farm Service Centres.

Table 4.11:

Principal Means of Mobility Used from Home to Farm.

Means of Mobility	No. of respondents by category of villages							
	I		II		III		Total	
	No.	%	No	%	No	%	No	%
Walking	50	83	66	66	69	43	185	54
Donkey	-	-	-		6	4	6	2
Bicycle	8	13	15	15	20	13	43	14
Motor-cycle	2	4	19	19	50	31	71	22
Bus	-	-	-	-	15	9	15	18
Total No. of respond-ents	60	100	100	100	160	100	320	100

Source: Field Survey (1986).

From Table 4.11 walking is the main means of mobility from home to farm used in all the three categories of villages. This may be due to the fact that most farms are located near to the farmers' homes thus requiring short walk to the farm. It could also be due to poor access roads to the farms or economic position of farmer. The use of bicycle and motorcycle is also employed for moving from home to farm in all the three categories, though highest in category III. It is also in this category that bus services are used to move to farms.

This is as a result of the good access roads which have enable farmers to acquire large farms far away from their homes for commercial farming.

Results presented in table 4.12 show that for movement from home to market, trekking is less because the farmer may need to carry goods either to or from the market. This has resulted in the use of other means of mobility, with the exception of farmers in villages of category I who have little or no access to other means of mobility. Farmers in villages of category II and III used buses.

Table 4.12:

Principal Means of Mobility Used from Home to Market

Means of Mobility	No. of respondents by category of villages.							
	I		II		III		Total	
	No	%	No	%	No	%	No	%
Walking	41	69	20	20	16	10	77	24
Donkey	-	-	4	4	4	3	8	2
Bicycle	8	13	9	9	8	5	25	8
Motorcycle	2	3	18	18	32	20	52	17
Bus	-	-	49	49	100	62	149	46
Two or more means	9	15	-	-	-	-	9	3
Total no. of respondents	60	100	100	100	160	100	320	100

Source: Field Survey (1986).

More than any other means. Motorcycles are also being used to a considerable extent in categories II and III. However, for villages of category I, trekking is the most important means followed by the use of two means at a time for the same purpose. This is a situation where a farmer may employ the use of motor vehicle or motorcycle to a point where the motorable road terminates then completes the remaining journey by another means of mobility (most especially trekking).

From results presented in Table 4.13, motor transport is the

Table 4.13: Principal Means of Mobility Used from Home to nearest Farm Service Centres.

Means of Mobility	No. of responses by category of villages.							
	I		II		III		Total	
	No	%	No	%	No	%	No	%
Walking	38	63	29	29	28	18	95	30
Donkey	-	-	20	20	15	9	35	11
Bicycle	8	13	4	4	2	1	14	4
Motorcycle	2	3	20	20	10	6	32	10
Bus	-	-	27	27	41	26	68	21
Two or more means	12	20	-	-	64	40	76	24
Total No. of respondents	60	100	100	100	160	100	320	100

Source: Field Survey (1986).

means of mobility mainly used in villages of categories II and III for carrying inputs especially fertilizer from F.S.C. to home. Villages in category I used walking more than any other means followed by the use of two means. The use of two means for the same purpose scored 40% in villages of category III because though these villages are highly accessible from other settlements, the internal circulation system within the villages may be bad due to poor planning.

4.5.2: Extent of Adoption of Innovations in the three Village Categories (except fertilizer)

The fourth hypothesis of this study relates to accessibility and adoption of innovations. Table 4.7 above shows the categories of villages and adoption behaviour of farmers for the selected innovations, again excluding fertilizer.

In order to find out whether there is a significant difference between the three categories of villages in their adoption behaviour, a chi-square test was carried out.

Calculated Chi-square	Critical Value ($P<0.001$)	Degrees of Freedom	Significance level
25.8	13.82	2	0.001

The Null hypothesis: There is no significant difference between the three categories of villages in their adoption behaviour.

From thecalculated chi-square, the null hypothesis is rejected, meaning there is a significant difference between the three categories of villages in their adoption behaviour. Table 4.7 shows a decreasing trend in the level of adoption of innovations from category III to I. Reasons responsible for this could be due to the fact that villages in the accessible category have both economic and social infrastructure especially the roads. These roads enable farmers to carry out their production activities without much problem. The availability of roads encourages the presence of extension workers, and it also enables them to carry out their work of disseminating information to farmers appropriately. Farm Service Centres are also available in these villages where farmers can buy inputs needed for the production.

The situation in villages of category II differs from what is obtained in category III because the roads in category II villages are mainly seasonal which tend to discourage extension activities and free movement of goods and services in the rainy season. Also, extension workers and F.S.C. are not available in each village of category II because of accessibility problem. Nevertheless, adoption of the selected innovations has been quite high due to the exposure these villages have.

Villages of category I lack all these economic infrastructure like roads and F.S.C. The fact that only few farmers are aware of the use of tractors, and lack of any farmer who has adopted the tractor, further explains how the non-availability of access roads constitutes a limiting factor to farmers who might want to adopt certain innovations. Thus only 45% of respondents have adopted one or more of the three innovations in villages of category I.

CHAPTER FIVE

CONSEQUENCES OF INNOVATION ADOPTION BEHAVIOUR

An innovation is of little use until it is distributed or diffused to others to use by them (Rogers and Shoemaker 1971). Almost no innovation comes without strings attached to it, which lead to the changes in a social system in question. Some of these changes are desirable while others are undesirable. Therefore innovations and diffusion are but immediate means to an altimate end; the consequences from adopting such innovations (Ibid).

Farmers' adoption behaviour with respect to the selected innovations has been influenced by different factors. In this chapter, farmers' reactions to the selected innovations, and the factors influencing such reactions, are examined and their implications for rural welfare discussed.

5.1 Farmers' Reactions to the selected Innovations.

A conclusion often reached at the end of a study is that peasants do not react to new ideas with a positive attitude (Rogers, 1962). Questions often asked according to Rogers are:

(1) Do not the prescribed ways of the peasants' ancestors have a value that is more self evident to them than the new ideas?

(2) Is it entirely necessary to supplement traditional ways in order to introduce new ideas?

Gunsfield (cited by Holden, 1972), says that modernity does not necessary weaken tradition, but that both tradition and modernity form the basis of ideologies and movements in which the polar opposites are converted into aspirations, and that traditional forms may supply support for, as well as against change.

Farmers in the study areas were interviewed on the four selected innovations involving simple management practices unlikely to exceed the comprehension of a majority of the farmers. The responses received show that farmers are quite willing to adopt the innovations, but some cannot because of various factors. Table 4.7 above showed the extent of adoption of all innovations except fertilizer in the three village categories. 79% of respondents in villages of Category III have adopted one or more of the three innovations concerned. Farmers in villages of Category II have 74% adopters while farmers in villages of Category I have only 45% adopters. This shows an increasing trend in the level of adoption from Category I to III. If the selected innovations involved simple management techniques, and the farmers also had a favourable attitude towards the innovations, what then are the factors that influence farmers' acceptance or rejection in the study areas? These factors are discussed in the next sections.

5.2 Factors influencing Acceptance or Rejection of Innovations

Agricultural innovations are intended to be adopted by individuals. According to Katz (1962) different sorts

of innovations require different units of adoption, as may be prescribed by different cultural or situational norms. Individual farmers have to make up their minds about whether or not to adopt a recommended practice, and once their minds are made up, they can go ahead and use it. This does not mean of course that the individual is a completely free agent, as he may be subjected to all kinds of pressures to adopt or not to adopt. But in the final analysis the decision is his in the specific sense that it takes only one person to implement the decision to adopt.

Obviously, one of the interesting things which may vary among adopters is the manner of arriving at the decision to adopt. The process of decision making for an individual has a system of stages such as awareness, interest, evaluation, trial and adoption (Rogers, 1962). This is relevant, however, not so much for its own sake, but for its possible consequences for the diffusion process. However, various factors come into play as a farmer undergoes the process of decision making, which influence this final decision on whether to adopt or not. These factors are discussed in the subsequent sections.

5.2.1 Access to Sources of Information

One of the major factors influencing farmers' reactions to innovations is the sources of information available to them as shown by the statistical test. Farmers in the study areas presented a variety of sources of information available to them on the four selected innovations. These sources of

information are extension workers, radio, friend, neighbour, market, church, etc. The sources can be categorised into two groups as official and non-official sources. The official sources are those established and maintained by government to keep the farmers well informed about agricultural development activities in general, e.g. extension workers, agricultural shows and radio. The non-official sources of information are those which are open to the farmer but over which the government has no control, e.g. friend, relatives, religious places, market, etc. Results presented in Table 4:8 show that 77% of adopters make use of official sources of information. However, when farmers were asked to indicate which sources of information they consider reliable in disseminating agricultural information, the responses received were as presented in Table 5.1.

Table 5.1.

Sources of Information considered Reliable by Farmers.

Source of information	Category of villages						Total	
	Cat.I		Cat.II		Cat.III			
	No	%	No	%	No	%	No	%
Extension workers	3	5	100	100	160	100	263	82
Radio	8	13	76	76	126	79	210	65
Agricultural show	-	-	36	36	60	38	96	30
Market	10	17	-	-	32	20	42	13
Neighbours	21	33	-	-	-	-	21	7
Friends	15	25	-	-	-	-	15	5
Others	15	25	-	-	-	-	15	5
Total no. of respondents*	60	-	100		160	-	320	

* - some farmers indicated more than one source.

Others - compound head, saw it myself, church etc.

Source: - Field Survey (1986)

Villages in categories II and III indicated extension workers as the most reliable source of information, because as they said, the extension workers are well trained in the various fields of agricultural production. Radio is the next source of information in terms of importance in the categories II and III, because it is capable of having a large audience at a time, while agricultural shows provide an opportunity for the visual demonstration of the innovations. In case of farmers in category I extension workers as a reliable source of information scored 5%, and this is due to their complete absence in this category of villages, resulting in the farmers not knowing their importance. Rather neighbour stands as the most reliable source of information on agricultural activities to farmers in villages of category I.

The type of information source available to a farmer affects his rate of adoption because an innovation is more likely to be adopted by an individual or group, if there is an opportunity first to see the innovation in action and witness its results (observability) and second to employ a portion of an innovation before having to employ the total innovation (triability) (Rogers, 1962). The evidently decreasing use of official sources of information (see chapter 4 above) by adopters in categories III, II and I respectively shows an unequal distribution of official sources in the three categories of villages especially the extension workers. Also due to differences in the level of

exposure to outside influence, and differences in socio-economic status in the three village categories, there is a decrease in the number of farmers who owned radios, and the chances of attending an agricultural show from category III to I.

However, a possible disadvantage seen in the process of disseminating information through extension workers is that the information passes through several mouths before reaching the farmer. In such circumstances the chances of over-simplification and possible distortion of the information being communicated are therefore great. Nevertheless, the personal contact provided by this channel is an advantage. It allows for questions and there is a practical demonstration by the change agent for the benefit of the farmer.

The major problems with the radio are that few farmers own radios due to its cost and maintenance. Again the fact that the listener cannot see the object of discussion and cannot also immediately seek for clarification is a disadvantage not to mention the language barrier.

Neighbours which stand as the most reliable source of information in villages of category I, also supply relevant information especially in the remote areas. Neighbourhoods which are locality based groups are assumed to include all people living in them. Lionberger (1960) said that local work-play activities, work exchange, mutual assistance and talk about farming continue to give special meaning to places that people refer to as neighbourhoods traditionally. For a farmer to pass information about any production method to his neighbour, he must have some bases to supply the information he is communicating.

The church as a social gathering influences the flow of information to farmers especially in villages of category I. This is because farmers believe that any information passed in the church is very reliable as it is always the truth. Even though the church does not exist primarily for the purpose of supplying farmers with information they need, it does provide many opportunities for the transmission of information relevant to the farmer.

5.2.2. Access to Innovations

The point being examined here relates to acquisition of the innovation as opposed to acquisition of information about the innovation. Knowledge that an innovation exists will be meaningless to the farmer who is the potential adopter, if he cannot lay his hands on the innovation. Access to the innovation is therefore an important factor influencing adoption.

Farmers have two main sources where they purchase fertilizer or improved maize varieties. These sources are Farm Service Centres and open market. But the distribution of F.S.C. in the three categories of villages is unequal with a decrease in their number with decrease in level of accessibility. Thus the villages that do not have F.S.C. have to buy these inputs from the market.

For the improved maize varieties, there is no problem in acquiring the seeds once a farmer has made up his mind to adopt the innovation. This he can get from any of the sources mentioned above, or even from a friend or neighbour without paying any thing much either in kind or cash.

After he has adopted, he then reserves the seeds he will plant for the subsequent years after each harvesting season.

To adopt a new practice such as fertilizer however, a series of activities have to be guaranteed. These are: fertilizer of the right kind for the soil, crops and climatic conditions, and in adequate amounts has to exist. It has to be transported into the area where it is to be used at the appropriate time, it also has to be stored in conditions that will not lead to its deterioration or destruction of the principal components such as ammonia, nitrate, etc. Then one requires the personnel to handle all these activities and to do so in such a way that the fertilizer is available to the farmer at the right time of the year and also at reasonable prices. In the study areas most of these activities do not operate as expected, because one discovers that the fertilizer is either not available at all, or the right quantities are not provided, resulting in farmers not using the recommended types and recommended doses for the various crops. Also the conditions under which the fertilizers are stored are so poor which has resulted in the deterioration of the principal components of the fertilizer, making some farmers believe that there are fake brands of fertilizers. There are some instances that the man in charge of the sales may just decide for some mysterious reasons that he does not particularly feel like working or that the given farmer is not worthy of the fertilizer. All these have resulted in some farmers not using fertilizer or discontinuance by earlier adopters of the innovation.

For innovations like tractors and ox-ploughs, only few farmers owned these implements in villages of categories II and III and none in category I because of the high cost involved in buying them especially the tractor. Most adopters therefore engaged in hiring from those who have been able to purchase these implements. There are also government owned tractors available at the tractor hiring units. The problems here are that the hiring charges are very high and always beyond the common farmers' means especially for the privately owned tractors. The government owned tractors are however hired out at lower charges, but the problem with them is that they are most of the time not in good conditions because of lack of spare and serviceable parts. Even where the tractors are in good working conditions, the persons in charge of the hiring unit may tend to be selective on who to allow the use of the tractor for some selfish reasons. Coupled with this is the fact that the number of tractors are too few to serve any effective purpose. These make peasants believe that the tractor as an innovation is meant for those who are highly placed in the society and not for every peasant farmer.

For villages of category I, tractors and ox-ploughs have not been adopted in them because of physical and accessibility problems.

5.2.3. Social Factors

The social factors investigated are literacy and age.

Age:

Age has a significant relationship with the adoption of innovations. The young and middle age farmers who are strong and capable of engaging in agricultural production rigorously, have adopted innovations more than the aged farmers who are traditional and sceptical about innovations. Young school leavers no longer migrate to towns because of the problem of unemployment in Nigeria which compels them to stay back in the village and farm. But the problem which the youths encountered is that they do not always have the capital to start the farming business. Some may not even have the land to start with, since land is normally being controlled by an elder member of the family. To improve this situation therefore, land and capital should be made available to the young school leavers who have a higher potential of adopting innovations more than the aged farmers.

Literacy:

Education is another social characteristic that may influence the rate of adoption of innovations. A large percentage of respondents indicated being able to read and write through different ways. Some have attended primary schools, post primary school, adult education classes, koranic schools, and some became literate through their personal efforts especially in the remote areas. Education might be expected to influence adoption behaviour in that it makes the farmer a more aware person because he becomes open to more sources of information, on new farm practices. The negative relationship found in the present study between literacy and innovation adoption,

however, suggests that other sources of information may be more important than the written word in inducing a favourable attitude towards innovation.

5.2.4 Economic Factors:

Jones (cited by Mirchaulum, 1976, p. 26) puts it that, "The economic characteristics of a farming innovation include its initial cost, its operating and maintenance cost, the rate at which an investment in it is recovered, and its net effect on farm income. It might be hypothesised that the higher the initial cost or the operating and maintenance cost.... then the slower will be the rate of adoption of a particular new farm practice" (Mirchaulum, 1976).

An initial capital is always necessary in order to enable a farmer adopt an innovation. Examining fertilizer adoption, farmers indicated that because of increases in the prices of fertilizer (due to the removal of government subsidy on the innovation), many farmers do not buy the quantities they need, while other farmers have to discontinue its use. Another economic factor that discourages farmers from the use of fertilizer is the fact that prices are not uniform. Fertilizer is being sold at the F.S.C. at the rate of ₦8.50 to ₦10.50 per bag of 50kg (depending on the brand). In the open market, prices for the same brands of fertilizer range from ₦12.00 to ₦15.00 per 50kg bag. This shows that farmers who have access to F.S.C. where they can buy fertilizer pay less as compared to those who have to buy from the open market. However not all villages have F.S.C. meaning that the disadvantaged villages do pay exorbitant prices for fertilizers as compared to the

farmers who have access to F.S.C. (assuming that enough quantities are available for the farmers to buy). There is a need for the government to review the current prices of fertilizer if peasants are to benefit from its use.

The quantity of maize that a farmer produces is determined by the benefits to be derived from its production when the production cost has been removed. Prices of inputs and crops are set by people outside the production circle who either because of ignorance or deliberately refuse to take into consideration the production cost before setting the prices for the improved maize. This discourages farmers from producing much for the market.

Initial capital is needed to either purchase or hire innovations like tractors and ox-ploughs. But since the cost of purchasing them especially the tractor is too high, most adopters resort to hiring. The maintenance cost of the tractor is also very high and all these factors have resulted in a small number of adopters, for this innovation. Thus the hypothesis by Jones is accepted because innovations involving higher initial and maintenance cost like tractor tend to be adopted at a slower rate unlike the ox-plough, improved maize and fertilizers.

5.2.5. Technical Factors

The technical attributes of an innovation also influence the rate of its adoption. Among these attributes according to Mirchaulum (1976), are the complexity, divisibility and conspicuousness of innovations and their compatibility with existing practices.

All farmers have adopted the use of fertilizer in all the three categories of villages. This is because the application of fertilizer is a very simple technique that does not require any special skill in its method of application. However some adopters indicated having had some problems with fertilizer usage at the initial stage of adoption. These problems were encountered as a result of farmers not knowing the type of fertilizer to apply to the various crops, the time and quantities to apply to crops which led to a negative result of the innovation. For example, some adopters said they apply fertilizer on the leaves of crops just as they had done with local manure and that resulted to the death of crops. This discouraged other farmers from adopting the innovation at the time it was introduced. This problem could not have been encountered if provision was made for change agents to instruct and demonstrate to the farmers how to apply fertilizer to crops instead of leaving them to learn through the process of trial and error. Nevertheless, fertilizer, if compared with the other innovations, is simple, non-visible, with a simple method of application, thus its high rate of adoption, by 100% of the respondents.

For the improved maize varieties, its method of cultivation does not deviate from the existing farm practices of cultivation. However what determines its being adopted is associated with its taste which farmers say is not as palatable as the local varieties. Apart from this, respondents complained that high doses of fertilizer are required for proper yields of the improved maize varieties,

a condition that can hardly be met by most peasants.

The use of ox-plough does not conflict with existing farming techniques. Though the ox-plough is not a complex innovation, it is divisible into many parts, i.e. the plough, two bulls, a cross-bar and a chain linking the cross-bar. One technical problem with ox-plough is the conditions in which the oxen are being kept. Sickness of the oxen (as complained by the farmers) is caused as a result of their being kept under unhealthy conditions. In some cases the bulls are taken to the Fulani herdsman only to be called for at the start of the rainy season. This results in the adopters of the innovation who have purchased it, not fully utilizing the oxen.

The originators of the scheme according to Mirchaulum (1976), had in mind the benefit to be derived from the cow dung in manuring farmers' fields. To be able to collect this, the farmer has to house the animals in a shed. Adopters of the plough do not seem to take this into consideration, but are rather interested in the speed of their work much more than the dung. Another technical aspect is the ease with which the plough can be used in different soils and locations. The ox-plough requires a sandy, clean area, free of stumps, and rocks. These conditions are only obtainable in Funtua Local Government Area. But in Jema'a Local Government Area, the clayey soils which are sticky in nature, presence of stumps and rocks have resulted in the non-introduction of the innovation into the area, talk less of farmers adopting it.

Technically, the tractor as an innovation is very complex, divisible into many parts, and tends to conflict with existing farming techniques. Firstly, tractor usage requires that the land to be cultivated be clean, free of rocks and stumps and well drained soils. These conditions are obtainable in Funtua area, and in a few places in Jema'a area which means that the innovation is not suitable for many parts of Jema'a Local Government Area where the soils are stony and sticky in nature. If tractors are used for cultivation in such stony areas, it leads to the breakdown of the machinery easily. Tractor usage also requires an adopter to have a large piece of land, a situation which is not obtainable in the study areas due to fragmentation of land through the system of inheritance. This means that a majority of the peasant farmers cannot adopt the use of tractor except those that can afford to acquire large pieces of land through purchase. These and other technical problems associated with the use of tractor have resulted in its low rate of adoption.

In conclusion it is evident that farmers have reacted to the selected innovations positively, realizing the benefits in adopting them, but are constrained by many factors.

5.3 Implications of Adoption behaviour for Rural Welfare

Rural development according to Mabogunje (1986) is the socio-economic transformation of a nation's rural economy from being a peasant subsistence agricultural economy to a

modern socialized agricultural enterprise, with all the social structures it entails. It also entails issues of growth, modernization and distributive justice. This is meant to reduce poverty through increased productivity, improvement of living standards and the reorganization of the rural masses to make the change self-sustaining.

An attempt has been made to effect such changes in the study areas through the dissemination of technical innovations. Farmers have a favourable attitude towards the selected innovations, knowing fully well that they are crucial for increased food production. The adoption behaviour of farmers towards the selected innovations however, has some technical, cultural and socio-economic implications for the welfare of the people concerned.

The method of land acquisition in the study areas before the introduction of these innovations was mainly by inheritance. This system of inheritance has resulted in fragmentation and decrease in size of land holdings by farmers with succeeding generations. With the introduction of these innovations, coupled with increased monetization of the Nigerian economy, some farmers have now resorted to acquiring larger farm lands through purchase to enable them to grow crops on a commercial basis thereby improving their standards of living. Those who could not afford to adopt the innovations due to various reasons, have continued to produce on a subsistence level and remain poor.

Increase in the sizes of farm-lands have resulted in a high demand for labour, because individual families can no longer cultivate their farms alone. Also the gandu system

which used to be the efficient work unit has broken down in recent decades due to individual aspirations and want of money resulting in some people offering labour for wages in order to earn extra cash. Thus the main type of labour used in the farms now is hired labour as compared to the communal labour that was mainly used before the introduction of these innovations. This means that farmers with a better socio-economic background will be able to acquire more labour than the poorer peasants.

Farmers' net-income is the benefit accruing to the farmer after the cost of production has been deducted (Aina 1985). Adopters of innovations have had their net-income increased which they used to further increase their production capacity. Adopters said they use the extra cash obtained from the adoption of these innovations to pay tax, pay children's school fees, buy household equipments, build modern houses, buy bicycles, motorcycles, cars, radio, etc.

It is evident that the introduction of these innovations has both desirable and undesirable consequences for the rural welfare. Those who have access to the innovations and have therefore adopted them, have had their socio-economic status improved. However the consequences are undesirable for the peasants who could not adopt the innovations due to various reasons. The result of this is a widening socio-economic gap between the adopters and those who could not afford to adopt. This has caused anxiety among peasants, who live in the midst of an emerging class of elites constituting only a minority in the society.

To resolve this problem created, there is need to provide an efficient means of making these innovations available to the peasant farmers. There is also need to reorganise the farmers so that they can have access to these innovations to make the change in agricultural production self-sustaining.

CHAPTER SIX

C O N C L U S I O N

6.1 Summary of Findings

This study on the implications of innovation diffusion for rural development, was focused on some villages in Jema'a and Funtua Local Government Areas. The villages were grouped according to their degree of physical accessibility. The study shows that 100% of the respondents have adopted the use of fertilizer, because it is a simple and cheap innovation to adopt. 71% of the respondents have adopted the use of improved maize varieties, which also reflects the ease in acquiring the innovation. The ox-plough has been adopted by 49% of the total respondents; while the remaining 51% have not adopted especially in the remote villages probably because of physical barriers like characteristics of soil and presence of stumps and stones as well as relative inaccessibility of the area.

For the tractor, though many farmers are in favour of its use, only about 24% have actually adopted its use because of the problems associated with its use especially its high cost and high hiring charges.

The study revealed that 71% of respondents are adopters of one or more of tractor usage, improved maize varieties and the use of ox-ploughs. The other 29% have not adopted because they have no physical or financial access to the innovations. For the various categories, 45%, 74% and 79% are adopters of one or more of these three innovations

in villages of categories I, II and III respectively.

It was discovered that farmers who have access to formal sources of information especially the extension workers adopt innovations more than farmers who do not have access to these extension workers. Younger farmers adopt innovations more than the aged farmers who are traditional and skeptical of innovation. The study also revealed that both physical and financial accessibility possitively enhance the rate of adoption of innovations. Innovations that are simple and non-divisible into different parts like fertilizer and improved maize varieties have been adopted by more farmers than the ox-plough and tractors which are complex and divisible into many parts.

However, it was surprisingly discovered that education does not seem to have influenced the adoption of the selected innovations, perhaps, because the information is disseminated to the farmers through interpersonal face-to-face contact.

It was also discovered that the implication of adoption behaviour on the rural welfare in the study areas is the emergence of an elite group of farmers, while the majority still produce at the subsistence level because of differences in the degree of accessibility to the selected innovations. This calls for ways to resolving these differences if Nigeria's agricultural production is to be improved to become self-sufficient.

6.2 Policy Implications of Findings

An important cause of under-development in the study areas is not that of lack of natural and human resources, but lack of proper apparatus to transform the traditional method of production to a modern and self-sustaining venture. Findings from the study therefore imply that an appropriate apparatus is needed to improve the agricultural production in the area. In the writer's opinion, the appropriate apparatus needed is the provision of infrastructure for agricultural production. These include the following:-

1. Adoption of innovations was found to depend on the farmer's level of accessibility to innovations. Accessibility here includes both physical and economic accessibility to innovations. The strategy for developing the study area should therefore start from the construction of a transportation network within the area, which should also be linked with other regions, so as to remove that hinderance caused by inaccessibility. This strategy fits into the National objectives for regional development which is already being implemented by the Directorate of Food, Roads and Rural Infrastructure. The provision of transportation network will break the physical barriers in disseminating information to farmers.

Economic accessibility refers to ability to pay the cost of the inputs needed by the farmers. The adoption of innovations always requires an initial capital to purchase the innovation, which a majority of the peasants do not have. There is therefore a need to provide small scale farming loans through banks to the farmers without any collaterals and little interest rates charge for the loans. Prices of inputs should also be subsidised to reduce the production cost.

2. The role of extension workers as the most effective source of information requires that their services be made more available to the farmers. This requires the government to make provision for extension workers for the farmers. The effectiveness of the extension workers in terms of innovation adoption, will depend on the frequency of contacts with farmers and extension workers' ability to communicate the necessary information to the farmer. So the number and method of selecting who should be an extension worker is important. Since the farmers are to be able to see the relation at the farm level between various kinds of crops and variety of farm inputs, the extension worker will have to make frequent contacts to the farmers. To bridge the communication gap between extensionist and farmer , the extension worker should be trained in the local language of the people he will work with. Preferably, extension workers should be farmers selected from a particular farming area, who will be trained on

. extension activities for some months and then sent to work with farmers in their own localities.

3. Education level of a farmer influences his level of awareness and his decision on an innovation that is made available to him. There is therefore the need to intensify the drive to educate our farmers especially through adult educati on classes which will help influencing their reasoning capacity. This helps a farmer to read materials like posters, bulletin, magazines, etc on farming practices without necessarily referring to the extension agent who may not be available when he is needed.

4. The distributing channels for inputs, and disposal channels for farm produce are very poor in the study areas especially in the remote villages. Farm Service Centres should be located at a walking radius of not more than 2 kilometres to every farming community, where inputs will be made available for the farmers to buy. Along with this should be collecting or market centres for buying farm produce at fixed and favourable prices to farmers taking into consideration the production cost. This will help farmers avoid having to sell the crops at give away prices to business-men.

5. Farmers in the study areas do not participate in making decisions on matters that affect them in their production activities. This has been reflected in the manner in which economic infrastructure like roads and Farm

Service Centres are sited. This is also evident from the fact that prices of crops are very low when compared to production cost. If farmers are allowed to participate in decision-making or at least kept well informed about matters that affect their welfare, they will feel they are part of the system and will participate in executing programmes that are meant for them.

In conclusion, therefore, one may say that the selected innovations have been accepted in Jema'a and Funtua Local Government Areas despite limitations brought about by physical, social and economic conditions of the area and poor sources of information. However, because of time and financial constraint the researcher was not able to compare the spatial diffusion patterns and the temporal patterns of adoption of innovations in the different categories of villages. Intensive and extensive research is therefore needed in this field to identify the pattern and process of diffusion in different parts of the country as a basis for sound policy formulation.

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APPENDIX 1

Farmers' Questionnaire

Serial No ..... Interviewer.....

Date .....

(1) Place of birth

Village ..... District L.G.A. .....

(2) Sex .....

Male ☐ Female ☐

(3) Age .....

(4) Religion

Christian ☐

Muslim ☐

Others specify ☐

(5) Tribe .....

(6) Educational level of respondent

(a) Can you read and write? Yes ☐ No ☐

(b) If yes state literacy level

Primary Education	
Adult Education	
Koranic Education	
Post Primary Education	
Others (specify)	

(7) Main Occupation

Farmer	
Trader	
Teacher	
Others (specify)	

(8) Secondary Occupation

Farmer	
Teacher	
Trader	
Other (specify)	

(9) What total land area do you have?

Type of ownership	Land area, (acre)
Inherited	
Purchase	
Hired	
Others	
Total	

(10) Which of these major crops do you produce?

Crop Type	Variety		Average quantity Produced	Percentage Total Produce
	L.	M		
Sorghum				
Millet				
Maize				

L - Local variety

M - Improved variety

(11) Why do you prefer the crops you produce to others?

Characteristics	Corn	Maize	Millet	
Taste better				
Have higher yields				
Involves less labour				

(12) a. Do you sell any of your crops?

Yes ☐ No ☐

b. If yes, what crops do you sell?

Crop sold	Quantity sold (kg)	Income realized ₦
Maize		
Corn		
Millet		
Others		

c. Where do you sell your crops?

Home ☐

market ☐

marketing boards ☐

others (specify) ☐

d. Are you satisfied with the medium of exchange?

Yes ☐ No ☐

e. If no, why are you not satisfied?

f. Are you satisfied with the prices offered for your crops?

Yes ☐ No ☐

1. If no why are you not satisfied?

(13) a. What type of labour do you used in the procuction?

Family ☐

Hired ☐

Communal ☐

Others (specify) ☐

b. If hired labour, what is your source of payment.for the labour?

Loan ☐

From sale of farm produce ☐

Earn from other occupations ☐

Others (specify) ☐

c. Why do you choose to used that type of labour?

d. If family labour used, what is work force of your family.

Age group	No of	Males	No of	Female
	Farming	Other work	Farming	Other Work
Below 15 yrs				
15 - 60 yrs				
Total				

(14) For how many months are you involved in the farming activities in the year and why?

(15) Have you recieved any assistance for your agricultural enterprice?

Yes ☐ No ☐

(b) If yes

Type	Source	Amount
Cash		
Kind		

(c) If loan, have you paid back?

Yes ☐ No ☐

ii. If no, why?

(d) If no assistance recieved why? not needed ☐

No access to any source ☐

Not aware of any source ☐

Others (specify) ☐

(e) Are you satisfy with the assistance recieved?

Yes ☐ No ☐

i. If no, why?

(f) In which other ways do you feel you can be assisted?

(16). Which of the following new practices are you aware of?

Tractor services ☐

Improved seeds (types) ☐

Ox-plough ☐

Fertilizer ☐

(b) Which was your first source of information?

Source	Innovations
Agric Officer	
Friend	
Neighbour	
Church	
Mosque	
Agric Show	
Radio	
Read about it	
Saw it myself	
Market place	
Others (specify)	
1. Tractor services	
2. Improved seeds	
3. Ox-plough	
4. Fertilizer	

(17). Have you ever used fertilizer?

Yes ☐ No ☐

(b) If yes, since when did you adopt the use of fertilizer?

(state no of years)

(c) What was your first source of information?

(d) Have you been using it annually since then?

Yes ☐ No ☐

(e) What are your sources of supply, in order of importance

Open market ☐

Co-operatives ☐

Farmers supply agencies (state) ☐

Others (specify) ☐

(f) Why do you use fertilizer?

(g) Who thought you how to use fertilizer?

Agric Officer ☐

Friend ☐

Read it ☐

Neighbour ☐

Others (specify) ☐

(h) What in your experience are the problems associated with the use of fertilizer?

1. When you have a problem in the use of fertilizer where do you usually approach for help?

Agric Officer ☐

Fellow farmer ☐

Others (specify) ☐

(18)

(a) If you don't use fertilizer, are you in favour of its use?

Yes ☐ No ☐

(b) If yes, state reason(s) why you don't use it.

(c) If not in favour of its use, state reasons(s).

(19) Have you ever used tractor for farming?

Yes ☐ No ☐

(b) If yes, since when did you adopt the use of tractor?

(c) If never used tractor, why?

not aware of its use ☐

not aware of any service ☐

aware but no access to it ☐

other (specify) ☐

(d) Where do you get the tractor?

Personal ☐

hiring ☐

govt owned ☐

other (specify) ☐

(e) Why do you use tractor?

(f) Who first introduced you to these.

Agric Officer ☐

Neighbour ☐

Friend ☐

Other (specify) ☐

(g) What in your experience are the problems associated with the use of tractor?

(20) Have you ever used an ox-plough for farming?

Yes ☐ No ☐

(b) If yes, since when did you adopt the use of ox-plough?

(c) What was your first source of information about the use of ox-plough?

Agric Officer ☐

Neighbour ☐

(d) Have you been using it annually since then?

Yes ☐ No ☐

i. If no, state reasons.

(e) Where do you get your ox-plough?

Personal ☐

hiring ☐

Govt owned ☐

Others (specify) ☐

(f) What in your experience can you say are the problems associated with the used of ox-plough?

(21) (a) Which of the following improve seeds have you ever used.

Types	Variety		Year of adoption
	L.	I.	
Corn			
Maize			

L - Local I - Improved

(b) Have you been planting them annually?

Yes ☐ No ☐

i. If no, why?

(c) What was your first source of the seeds?

Extension worker ☐

Market ☐

Neighbour ☐

Others (specify) ☐

(d) Why do you plant improved seeds

Crop	Reason for planting
Maize	
Sorghum	

(e) What in your experience are the problems associated with the use of improved seeds.

22. What are your means of mobility

Means	Ownership	Access Roads		
		Good from house to	Good from farm to	None
Lorry	Personal			
Motorcycle	hired			
Bicycle	govt. owned			
Bus				
Donkey				

23. Which of the following sources of information do you consider most effective for telling people about new ideas in order to importance?

Source	Ratings
Agric Officer	
Compound head	
friend	
neighbour	
church	
mosque	
Agric shw	
radio	
market place	
others (specify).	

(b) Why do you consider the source(s) most effective?

24. State any changes in lifestyle because of the use of any or all the new practices.

25. What suggestions in your opinion can improve the welfare of the rural masses?

APPENDIX 2

Extension workers' Questionnaire

Serial no..... Interviewer .....

Date ..... Village..... District.....

(1) Age .....

(2) Sex .....

(3) Marital Status .....

(4) No. of wives .....

(5) Educational level .....

Primary education

Post primary education

Adult education

(6thers (specify)

6. Number of Extension service worker in the district

No. of Ext. Staff in district	Ext. service work experience		No. of villages supervised	Distance of farm from St.	
	Date arrived Station	Elsewhere Years		Near- est	Far- thest

7. Which of the following do you have?

Radio ☐ Motorcycle ☐

Car ☐ Bicycle ☐

Others ☐

8. Types of innovations in use in your locality (district)

Innovation	No. of first adoptes by your records	Distance from your locality in km	
		Farthest	nearest
Ox-plough			
Tractor			
Improved Seeds			
Fertilizer			

9. What are your general activities as an Extension service worker in the locality?

10. How do farmers respond to innovation adoption in your area?

Innovations	ratings or respondence			
	1	2	3	4
Improved seeds				
Fertiiizer				
Ox-plough				
Tractor				

1. Encouraging i.e. rate of adoption fast.
2. Disappointing i.e. rate of adoption slow
3. Could have been more encouraging if enough imputs were available.
4. Others (specify)

1. What are your special problems of the extension service work in your area list in order of importance.

12. Which institution or authorities in your locality (district) have been particularly influential in ensuring the success of your extension service.

13. From your experience, what are your suggestion to encourage higher rate of innovation adoption to increase crop production in your locality?

APPENDIX 3

Chi-square test for any significant difference between adopters and non-adopters in the sources of information used.

$$\chi^2 = \sum \frac{d^2}{e}$$

a) Observed frequencies

	adopters	non-adopters	
Extension workers	170	62	232
Radio	42	84	126
Friend	23	24	49
Neighbour	20	38	58
Others	21	42	63
	276	250	526

b) Expected frequencies

Extension worker	$\frac{121}{276 \times 232 / 526}$	$\frac{111}{250 \times 232 / 526}$	232
Radio	$\frac{66}{276 \times 126 / 526}$	$\frac{59.8}{250 \times 126 / 526}$	1 26
Friend	$\frac{24.6}{276 \times 47 / 526}$	$\frac{22.3}{250 \times 47 / 526}$	49
Neighbour	$\frac{30.4}{276 \times 58 / 526}$	$\frac{27.5}{250 \times 58 / 526}$	58
Others	$\frac{33}{276 \times 63 / 526}$	$\frac{29.9}{250 \times 63 / 526}$	63
	276	250	526

$$\chi^2 = \frac{(170 - 121)^2}{121} + \frac{(62 - 111.6)^2}{111.6} +$$

$$\frac{(42 - 66)^2}{66} + \frac{(84 - 59.8)^2}{59.8} +$$

$$\frac{(23 - 24.6)^2}{24.6} + \frac{(24 - 23.3)^2}{23.3} +$$

$$\frac{(20 - 30.4)^2}{30.4} + \frac{(38 - 27.8)^2}{27.8}$$

$$\frac{(21 - 33)^2}{33} + \frac{(42 - 29.9)^2}{29.9}$$

$$= 19.2 + 20 + 8.7 + 9.8 + 0.1 + 0.1 + 3.6 + 3.7 + 4.4 + 9.4$$

$$= 74.5$$

degrees of freedom =
(rows - 1) x (columns - 1)

$$= (5-1) \times (2-1)$$

$$= 4$$

APPENDIX 4

Chi-square test for any significant difference between the three categories of villages in adoption behaviour.

$$\chi^2 = \sum \frac{d^2}{e}$$

Observed frequencies

	adopters	non-adopters	
Category I	27	33	60
Category II	74	26	100
Category III	127	33	160
	228	92	320

Expected frequencies

	adopters	non-adopters	
Category I	$\frac{228 \times 60}{320} = 42.7$	$\frac{92 \times 60}{320} = 17.2$	60
Category II	$\frac{228 \times 100}{320} = 71.2$	$\frac{92 \times 100}{320} = 28.8$	100
Category III	$\frac{228 \times 160}{320} = 114$	$\frac{92 \times 160}{320} = 46$	160
	228	92	320

$$\chi^2 = \frac{(27 - 42.7)^2}{42.7} + \frac{(33-17.2)^2}{17.2} +$$

$$\frac{(74-71.2)^2}{71.2} + \frac{(26-28.7)^2}{28.7} +$$

$$\frac{(127-114)^2}{114} + \frac{(33-46)^2}{46}$$

$= 5.8 + 14.5 + 0.1 + 0.25 + 1.5 + 3.6$

$= \underline{25.8}$

df $= (R-1) \times (C-1)$

$= (3-1) \times (2-1)$

$= \underline{2}$

APPENDIX 5

Chi-square test for any significant different between age level in adoption behaviour.

(a) Observed frequencies

	adopters	non-adopters	
15 - 29	49	15	64
30 - 55	139	27	166
≥ 56	40	50	90
	228	92	320

Expected frequencies

	adopters	non-adopters	
15 - 29	$\frac{45.6}{\frac{228 \times 64}{320}}$	$\frac{18.9}{\frac{92 \times 64}{320}}$	64
30 - 55	$\frac{126.8}{\frac{228 \times 166}{320}}$	$\frac{47}{\frac{92 \times 166}{320}}$	166
≥ 56	$\frac{64}{\frac{228 \times 90}{320}}$	$\frac{25.8}{\frac{92 \times 90}{320}}$	90
	228	92	320

$$\chi^2 = \frac{(49-45.6)^2}{45.6} + \frac{(15-18.9)^2}{18.9}$$

$$\frac{(139-126.8)^2}{126.8} + \frac{(27-47)^2}{47}$$

$$\frac{(40-64)^2}{64} + \frac{(50-25.8)^2}{25.8}$$

$$= 0.3 + 0.6 + 10.2 + 2.1 + 2.7 + 7$$

$$= 22.9$$

degrees of freedom

$(3-1)\ (2-1)$

2×1

$= 2$

APPENDIX 6

Chi-square test for any significant difference between literacy level and adoption behaviour.

$$\chi = \sum \frac{d^2}{e}$$

(a) Observed frequencies.

	adopters	non-adopters	
Literates	190	88	278
Illiterates	38	4	42
	228	92	320

(b) Expected frequencies.

	adopters	non-adopters	
Literates	$\frac{228 \times 278}{320} = 198$	$\frac{92 \times 278}{320} = 80$	278
Illiterates	$\frac{228 \times 42}{320} = 30$	$\frac{92 \times 42}{320} = 12$	42
	228	92	320

$$\chi^2 = \frac{(190-198)^2}{198} + \frac{(88-80)^2}{80}$$

$$+ \frac{(38-30)^2}{30} + \frac{(3-12)^2}{12}$$

$$= 0.32 + 0.8 + 2.13 + 5.3$$

$$= \underline{\underline{8.6}}$$

degrees of freedom

$$= (2-1)\ (2-1)$$

$$= 1 \times 1$$

$$= \underline{\underline{1}}$$