TITLE OF DISSERTATION

SPATIAL DIFFUSION PATTERNS IN THE RESULTS OF SIDA SUPPORTED INTEGRATED RURAL DEVELOPMENT PROGRAMME (IRDP) ACTIVITIES IN IKUMBI PROJECT AREA OF ISOKA DISTRICT.

by

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LUSAKA

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This dissertation of Sontwa Sinkala is approved as fulfilling part of the requirements for the award of the Master of Arts in Geography by the University of Zambia.

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	7/8/84

DEDICATION

To my late father and friend who saw the beginning, but could not see the successful completion of this work, will be sadly missed; And to Musyani for joining me at the University of Zambia, I gladly welcome him and wish him luck.

ABSTRACT

This dissertation is the result of research undertaken in Ikumbi IRDP project area of Isoka district from September, 1982 to February 1983. The study sought to analyse Zambia's rural development policy in general and to evaluate and analyse the results of this, especially in terms of the spatial diffusion of innovations in the Swedish International Development Agency (SIDA) supported Integrated Rural Development Programme (IRDP) in Ikumbi project area in particular.

Zambia like many developing countries is striving to narrow the gaps that exist between the urban and rural areas and between the people living in these areas. This is so because it has been realised that the majority of the people live in rural areas and a majority of them live in poverty. Several policies have been adopted in these attempts to improve conditions in the rural areas and to stimulate rural development. Increasingly, attention is focussing upon an integrated approach such as that pursued in the Ikumbi IRDP.

In this study the success of the IRDP was evaluated in terms of the rate of adoption of agricultural innovation. The researcher also attempted an overall evaluation of SIDA-IRDP strategy which is based on the growth pole theory with emphasis on what economists term as spread effects which in geography can be seen as the diffusion of an innovation in space. In particular the study sought to identify

the spatial variations through time in the participation of people in marketed agricultural production with coffee and wheat as the principal indicators. The identification took the form of adoption by households of innovation practices of growing the said crops. This study also attempted an identification of the facilitating and constraining factors in the diffusion process. These could be the socio-economic characteristics of the people, the physical features of localities or the infrastructure of the area.

It was found that there was an inverse relationship between distance from Old Fife which is the innovation centre and the rate of adoption for both coffee and wheat. This is probably because households close to the innovation centre are more likely to get information from agricultural and other institutional agents based there than if they were far away from the centre. It was also seen that there was some correlation between the time period since the crop was introduced or supported and the number of households adopting the crop. To begin with more people were adopting the innovations with time, but in recent years, deviations from this trend have been growing. The upward trend was a result of the incentives like subsidies on major inputs like fertilizers and seedlings/seeds which were met by SIDA-IRDP. When the subsidies were withdrawn, the down ward trend was the result. Socio-economic characteristics on the adoption process showed that not all of them had a direct influence on the adoption of an agricultural innovation. The socio-economic characteristics considered included

educational level attained, migration experience, work involved in by those who had migrated and household size. It was found that only the latter conformed to the assumption that the larger the household the higher the likelihood of that household to adopt an agricultural innovation which proves the need for more labour in agricultural development especially at small-scale level.

Households in certain areas, which are close to the innovation centre and which have a well developed infrastructure and households of certain socio-economic characteristics like large family size benefited most from the SIDA-IRDP activities in Ikumbi project area. There was on the whole little overall spread effects in the area.

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This dissertation could not have been possible without the help of a great number of people. I would like to record my appreciation of the time and effort these people freely gave to help me understand the work of the Integrated Rural Development Programme (IRDP) in the Ikumbi Project area. All the people who were interviewed in their working places - be it in the offices or fields - were happy to discuss my subject and showed genuine interest and concern which consequently made my interviews enjoyable.

I am especially grateful to those farmers and officers who, despite their busy schedules, so willingly accepted to be interviewed and offered me hospitality.

I am particularly indebted to Dr. A. P. Wood who as my Supervisor guided me in the preparation of this dissertation. Mention should be made here that Dr. A. P. Wood accepted to be my Supervisor at short notice when my initial supervisor Mr. C. Musampa had to leave for further studies abroad. Dr. A. P. Wood took the new responsibility willingly and advised me accordingly even when due to one reason or another was at a point of giving up.

In the field, especial mention should be made of Mr. B. Kashiwa an agricultural extension officer at Old Fife who took me round the Ikumbi IRDP project area on his motor cycle and introduced me to many farmers in the area.

This dissertation was typed by Miss J. E. Mulenga and the maps were drawn by Mr. A. Musitini of the Geography Department, UNZA. The data was fed into the computer by Mr. P. Mumeno of the Educational Research Bureau, UNZA while Dr. R. Henkel kindly offered me advice on the statistical tests used. Their hard work is gratefully acknowledged.

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CHAPTER ONE

RURAL DEVELOPMENT AND INTEGRATED RURAL DEVELOPMENT

1.01: HISTORICAL SURVEY OF DEVELOPMENT STRATEGIES

It is now widely agreed that the core of the world poverty problem is mainly concentrated in the rural areas of the developing countries. This calls for broad-based rural development policies in an attempt to alleviate this situation. This realisation of the need for rual development, is however, a recent one. The different ways in which poverty has been viewed, the importance accorded to rural development and the different approaches and strategies adopted have all undergone various changes especially after the early 1950s.

Rural development is defined "as a strategy designed to improve the economic and social life of a specific group of people - the rural poor" (IBRD., 1975 p. 3). It seeks to make available to these poor people in rural areas the benefits of development. Poverty on the other hand can be defined either in relative of absolute terms. Absolute poverty refers to an income level below which man's basic needs of food, water, shelter and clothing cannot be met. Usually, this is based on an arbitrary criterion of an income equivalent to US $50 or less per year. Relative poverty refers to those having incomes "above the equivalent of US $50 but below one third of the national average" (IBRD., 1975 p. 4).

Looking at the development literature of the early 1950s, it is seen that the rural sector was looked at as a supplier of food, raw materials and labour for industries in urban areas, (Lee, 1980). Agriculture was given low priority compared to industry and hence resources were diverted from it to the modern industrial sector which was then thought capable of absorbing the excess supply of rural labour. Development of rural areas was thus not a primary concern. The best means of ensuring eventual prosperity for all was to maximise the overall rate of growth and this was seen to be most easily achieved through industrialisation.

Industrial and urban development were given first priority as opposed to agricultural and rural development. The results of such an approach were that islands of development emerged in a sea of poverty. These islands of development were the rich areas, towns on major communication routes and areas favoured by their comparative advantage over others. Examples here include Zambia's Copperbelt, most administrative towns of African countries and cash crop producing areas like the fertile highlands of Kenya growing coffee and tea, the western highlands of Cameroun growing coffee and the sugarcane plantations of Swaziland.

Such simple dualistic patterns so widely accepted to the last three decades are now heavily criticised. Firstly, such development benefited only a few. Secondly, it encouraged rural to urban migration which disrupted the rural economy and production. Thirdly, the industrial sector was not able to absorb the soaring urban workforce with the result that urban unemployment increased and other associated problems like squatter settlements developed in urbana areas.

Between 1950 and 1975, most developing countries performed reasonably well in terms of growth using GNP and GNP per capita as indicators. Developing countries had an average annual growth in GNP per capita of 3.4 per cent. However, growth in per capita agricultural and food production was lower at only 0.7 per cent from 1961 to 1970 and 0.2 per cent per year between 1970 and 1976 (FAO, 1978, table 1.2). This shows the considerable and increasing difference in growth of the rural and industrial sector and suggest that the spread of poverty in rural areas is, therefore, not caused by any general stagnation of economic growth in these countries, but by the limited effort that has been made to develop the rural areas.

While this increasing poverty and poor performance of the agricultural sector, together with the criticisms of the

dualistic approach have led to the realisation that agriculture must be given greater attention, other factors have reinforced this shift in emphasis. In particular it is now recognised that agriculture can play a major role in the generation of employment, an increase in national income and foreign earnings and the provision of raw materials for the industrial sector.

Rural development can be seen as offering the only reasonable way of solving the massive unemployment problem faced by the developing countries while at the same time helping to reduce intersectoral disparities. It has also become increasingly apparent that progress in other sectors of developing economies is contingent upon the creation of viable rural bases. President Nyerere of Tanzania, for example summarised the interdependence that exists between rural development and all other aspects of development in his introduction of Tanzania's Second National Development Plan, saying

> "the decision to give top priority to rural development does not only affect what is done in rural areas; it also has implications for every other aspect of the development plan"

(Government of Tanzania, 1969, p. iv).

With the realisations in the late 1960s of the neglect of rural areas, that development is spatially differentiated, that poverty itself is not evenly distributed both

within countries and among countries, and that agriculture can play an important role in broader development the development literature and development plans of many developing countries became sensitive to the rural sector particularly the poverty stricken areas. President Kaunda of Zambia emphasised that

> "we must first succeed in developing the rural areas, no matter what our performance is in other sectors" (G.R.Z. 1971, p. iv).

This typifies the attitude adopted by governments of many developing countries as they recognised the limitation of earlier focuses on industrialisation and redirected their attention to rural development.

As a result, governments in developing countries began to moderate the cruder aspects of their dualistic policies and adopted regional development strategies and policies in an attempt to redress the disparities and imbalances that exist between and within regions. However, it is evident that this shift in emphasis has been more apparent than real. The neglect of rural areas in development practice has persisted. For example, during Zambia's First National Development Plan, only K88.4 million representing 15.7 per cent of the total public investment (out of K563.6 million capital expenditure) went to the rural sector. In the Second National Development Plan, only K152.5 million (out of total investment outlay of K1,956.4 million) was allocated

for the development of rural areas as opposed to K655 million for mining and industry (Ollawa, 1976, pp. 25 - 28). The situation has been similar in many other developing countries and so despite an emphasis in rhetoric towards the rural areas, little improvement in rural life has occurred.

Even if an increase in the share of total development resources devoted to agriculture is achieved, it does not automatically bring about broad-based growth in rural economy. Whether this happens or not depends on the agrarian structure especially the degree of inequality in the distribution of productive assets like land, capital, access to extension services and the prices for produce. This crucial fact about the agrarian structure in the context of rural development policies was barely recognised in the mainstream of development literature of the 1950s (Lee, 1980). In the 1960s and the 1970s many developing countries were trying to develop the rural areas by emphasizing the need for land reforms (examples, are Ethiopia and Kenya) in order to obtain a better distribution of resources among the rural populace. These countries were also encouraged to achieve better extension services and prices for the produce.

Nonetheless, there continue to be problems of social bias in rural development. What little investment does go into agriculture tends to give priority to the progressive and already "better-off" farmers and many policies are primarily benefitial to the rural elite. Many developing countries have a belief that modern mechanised farming will contribute more to agricultural output than peasant farming and that investments in favour of large farms produce rapid returns in terms of increased availability of food. Sometimes much attention is paid to those farmers who grow cash crops while those who grow food crops are left to fend for themselves (IBRD, 1982).

Even agricultural institutions providing extension services, credit, research and marketing usually do not cater for those farmers in the traditional sector, but rather concentrate on "modern" farmers. Notwithstanding all these disadvantages, peasants are also usually underpaid for most of their crops (IBRD, 1982, p. 44).

Some policies even increase rural poverty. For instance the emphasis on mechanised agriculture and modern farmers has serious repercussions in the developing countries whose rural economies have a plentiful supply of labour (Stahl, 1974, pp. 103 - 105). The substitution of tractors and other farming equipment for labour to a very large extent increases rural unemployment and contributes directly to the falling wages in rural areas leading to more poverty.

There are basically three reasons why the peasant, small-holder sector must be the focus of a growth oriented rural development strategy. Firstly, most development literature points to the fact that the large number of poor households are in rural areas, hence poverty in Africa is predominantly a rural phenomenon (IBRD, 1975, p. 4). This, therefore, means that the best way to meet the basic needs of those most in need is by raising the output and income of small farmers. Secondly, although small holder production accounts for the majority of agricultural output in most African countries, its real potential has yet to be realised in the sense that the use of off-farm inputs is still quite low, yields are still low and specialisation in production is uncommon. Lastly, it is cheaper to raise output at least for most food crops by paying attention to small holders rather than by concentrating on extensive mechanisation.

However, due to the limited funds of most governments of the developing countries, attention that must be paid to small holders must be selective. As a result emphasis tends to be on those areas where the physical resource base and the already existing human and physical infrastructure provide the pre-conditions for a rapid return from any investment. Hence although governments realise the need for wider agricultural development and for

attention to be focused on the poor, insufficient efforts are being undertaken in this direction to eradicate poverty throughout the rural areas of Africa.

1.02. SPATIAL THEORIES RELATING TO RURAL DEVELOPMENT

1.02.1 Some evolutionary aspects of development studies

Brookfield (1975, pp. 2 - 4) says that interest on issues of development has a long history. The first major contributions in the theory of development are often associated with classical economists of the eighteenth and nineteenth centuries like Ricardo, Malthus, Marx and Smith. However, the work of these economists was pre-occupied by the fact that the industrialising countries of Europe were experiencing rapid economic growth. As a result they showed little or no concern about the poor living conditions of the people in developing countries, parts of which were still only being visited for the first time by European traders at the time of these writings.

In the twentieth century, there were basically two branches of positive economic theory. Firstly, there was the least cost and locational theories which looked at the spatial organisation of activities (e.g. Alfred Weber, 1929; von Thunen 1966 and Walter Christaller, 1966). Such studies, which attempted the theoretical determination of the price of goods and the behaviour of both the producers and consumers in the market were valid for

industrialised countries with monetised economies. However, they were inadequate to explain the pattern of development around the world and especially the spatial changes in the developing countries. The second branch of positive economic theory concentrated on the supply - oriented growth models. These were basically the Kenynesian macro-economic models which attempted to explain the cyclical unstable nature of the economic system in nations which had already achieved self sustaining growth in a full employment situation. However, these models have been heavily criticised mainly because of the assumptions adopted which are highly unrealistic and because of their inapplicability to a large part of the world especially the developing countries on the periphery of the capitalist economy. They are also criticised due to their neglect of internal income distributions, economic structure and regional inequalities (Brookfield, 1975, Glasson, 1978).

The two branches of positive economic theory were, therefore, found inadequate in many ways for studies of development in developing countries. These two groups of theories could not explain

> "why and how unequal rates and levels of development were being maintained so that policies could be promulgated to reduce the development gap between developed and less developed areas"

(Browett, 1980, p. 59). Both theories failed to explain clearly the initiation and perpetuation on economic growth in space, and gave insufficient consideration to the importance of interdependence, the interaction between regions, and to those regions which were not experiencing economic growth or self-sustaining growth (Browett, 1980).

The outcome of this failure of economic theory to explain the uneven pattern of development both between and within regions were the core-periphery theories of Myrdal (1957), Hirschman (1958) and Friedman (1967). This is one group of regional growth theories which clearly recognises that regional growth may be divergent rather than convergent. The general argument of such theories can be simply illustrated by comparing the relative fortune of two regions A and B. Region A initially develops faster than Region B because it possesses a variety of natural and/or man-made advantages. However, contrary to many growth theories, this divergence may not be self-righting, infact this process may be cumulative with the rich getting richer and the poor getting poorer.

The major assumption of the core-periphery theories is the existence of dualism between traditional agriculture and modern industry. Core-periphery models can, however, also operate in solely agricultural or solely industrial

economies. Similarly, a number of two sector essentially similar models describe the differences between the rich and poor nations and the centre and periphery of a nation.

The core-periphery theories have been found to be valid for explaining development problems on macro scale but are heavily criticised on their failure to take the political economy into account. The core-periphery model was introduced in regional analysis by Friedmann. He identified core regions as territorially organised subsystems of a nation or society with a high potential for innovative change while periphery regions are those subsystems which depend on the core region and its instututions for their development. Periphery regions are usually identified by their relations of dependency to a core region and these two regions form a complete spatial system.

In the continuing search for better development theories, the past two decades saw the emergence of two closely related notions which gained popularity in the planning of development for lagging regions. These notions are the concepts of growth pole and growth centre (Glasson, 1978). These concepts have been adopted as planning instruments in many countries.

Growth pole may at this stage be defined as

> "an urban centre containing a set of expanding activities which induce further economic development throughout its hinterland"

(Brookfield, 1975, p. 106). This theory was pioneered by Perroux and much of his work focuses on the development of growth poles in economic space (Glasson, 1978). Economic space has an industrial development implication. Perroux broke away from the limiting geographical dimensions adopted by Christaller and Losch in their central places theory which looked at the location of economic activities only in

geographical space. Despite the fact that Perroux recognised industrial growth as being concentrated in various spatial locations, his concept of growth pole did not emphasise geographical space and hence has no spatial or geographical connotation.

Economic space has within it centres or poles from which centripetal forces radiate attracting development to those centres. Perroux also acknowledged that growth poles would exist in geographical space, but it was Boudeville who extended the original theory to include the geographical space. The term growth pole can, therefore, be taken to refer to the original concept of Perroux without any specific dimension, while the term growth centre refers to extensions made by Boudeville to include spatial location.

The growth centre theory may be used as a tool in providing an effective geographical location of each facility and service to help the farmers in that locality. Planning for agricultural development must consider this because these facilities and services are usually interdependent and hence must be planned together. During planning, the centre becomes the basic unit for creating and expanding a progressive rural structure. It is the growth that meets the needs of the farmers within it by providing them with the services and facilities they need in order to increase production.

The basic concepts and subsequent refinements and developments are to be found in the literature of Myrdal (1957), Perroux (1964), Boudeville (1966) and Hermansen (1968). From the various writings on growth poles and growth centres, the following basic economic concepts and their geographic developments can be identified:

a. The concept of leading industries:

This recognises that at the centre of growth poles are large propulsive firms which belong to rapidly expanding or leading industries which dominate other economic units. The original geographical location of such industries in certain focal points in a region may be a result of factors like the localisation of natural resources (like water or mineral) the localisation of man-made advantages (like communications or labour supply), or simply the result of mere chance. The leading industries may perpetuate the pattern of economic development once begun but advantages or stimuli to development may also spin-off to the neighbouring rural areas.

b. The concept of polarisation:

This states that due to the rapid growth of the leading industries, other economic units come

into the pole of growth. This is due to internal economies of scale. Implicit in this process of polarisation is that other parts of a country lag behind, thus increasing the differences between regions or parts of a country. This economic polarisation will inevitably lead to geographical polarisation with the flow of resources to and concentration of economic activity at a limited number of centres within a region while the rest of a country stagnates.

c. The concept of spread and backwash effects:

This concept states that with time, the dynamic propulsive qualities of the growth pole radiate outwards into the surrounding space. Spread effects are those forces favouring convergence between the rich and poor regions. As the rich region grows, it may demand more products from the poor region thus stimulating its growth. These trickling down or spread effects are particularly attractive to the regional planner and have contributed to the popularity of the theory as a policy tool.

Spread effects are, however, offset by the backwash effects which stress that the demand by the rich regions from the poor regions is usually only of cheap agricultural goods which do not bring in as much money as do consumer goods which are made from the same cheap agricultural raw materials and sold to the

poor regions. There is also outmigration of skilled labour and capital from the poor to the rich regions which tend to reduce their ability to develop.

1.02.2 Innovation diffusion and the micro pattern of change

While macro and meso scale studies of differential development have developed the theories outlined above, at the micro scale theories have also been developed concerning the pattern of innovation and adoption of new technology, inputs and ideas has become a major focus of attention in recent decades. The study of these patterns has focused on one particular theory, that of innovation diffusion, which considers how new innovations spread through a community.

Geographical theory on diffusion was pioneered by Hagerstrand (1967). He argued that the likelihood of innovation adoption depends on access to information. This may be illustrated by a model of non-directed diffusion in which information leading to adoption is exchanged primarily through distance biased networks of interpersonal or face to face contact. This tendency for diffusion to be influenced by distance was termed as the neighbourhood effected.

While distance has been recognised to be one major influence upon innovation it does not explain the totality of the pattern. In the study of the diffusion process, there is also need to recognise the concepts of the origin of what is being diffused the carriers or agent that are making diffusion possible, the channels or routes through which diffusion is taking place, the barriers that may hinder the process of diffusion and the receivers of whatever is being diffused (Haggett, 1975). The outlined concepts may help in deviating the hypothetial diffusion pattern in that the carriers of an innovation through their different behaviour can influence the pattern of diffusion. Carriers move along channels or routes which are often not evenly distributed which result in selective movement which also affects the pattern of diffusion. Furthermore, the barriers and resistance to innovation are not equally distributed in space and so they also produce a different pattern of diffusion.

Brown (1975) talks about the importance of information flow in innovation adoption. He argues that individual adoption is usually preceded by the establishment of the diffusion agencies through which the innovation is distributed and that the locations of these agencies and their distributional policies, therefore, affect the availability of both information about the innovation and

the innovation itself. Hence an area could receive the same information but due to the behaviour of the people in that area which is not the same, some may decide to adopt while others may not resulting in different pattern of diffusion.

The diffusion model has been extended to include the effects of personal characteristics like educational level, migration history, social status and work experience which influence the structure of channels of communications and also accessibility to resources which are necessary for adoption to take place (Brown and Moore, 1969, Hudson, 1972, Blaikie, 1978 and Cox and Golledge, 1981). The charateristics of the recipients affect the pattern of diffusion in three ways. Firstly, through the receivers' different behaviour which very much affects their access to information. Secondly, through their different personal characteristics and their response to the available innovation information and lastly through the receivers' different economic resources and response even if they get the same innovation. The right behaviour, favourable personal characteristics and access to economic resource may, therefore, lead to adoption.

A resource theory of innovation diffusion has also been developed to show the influence of factors such as individual access to the means of production, the physical infrastructure in the area, the resources provided

by the government and other private institutions to induce development and social and/or economic change. This would include things like availability of loans, the development of transportation and communication infrastructure, crop subsidies and many more.

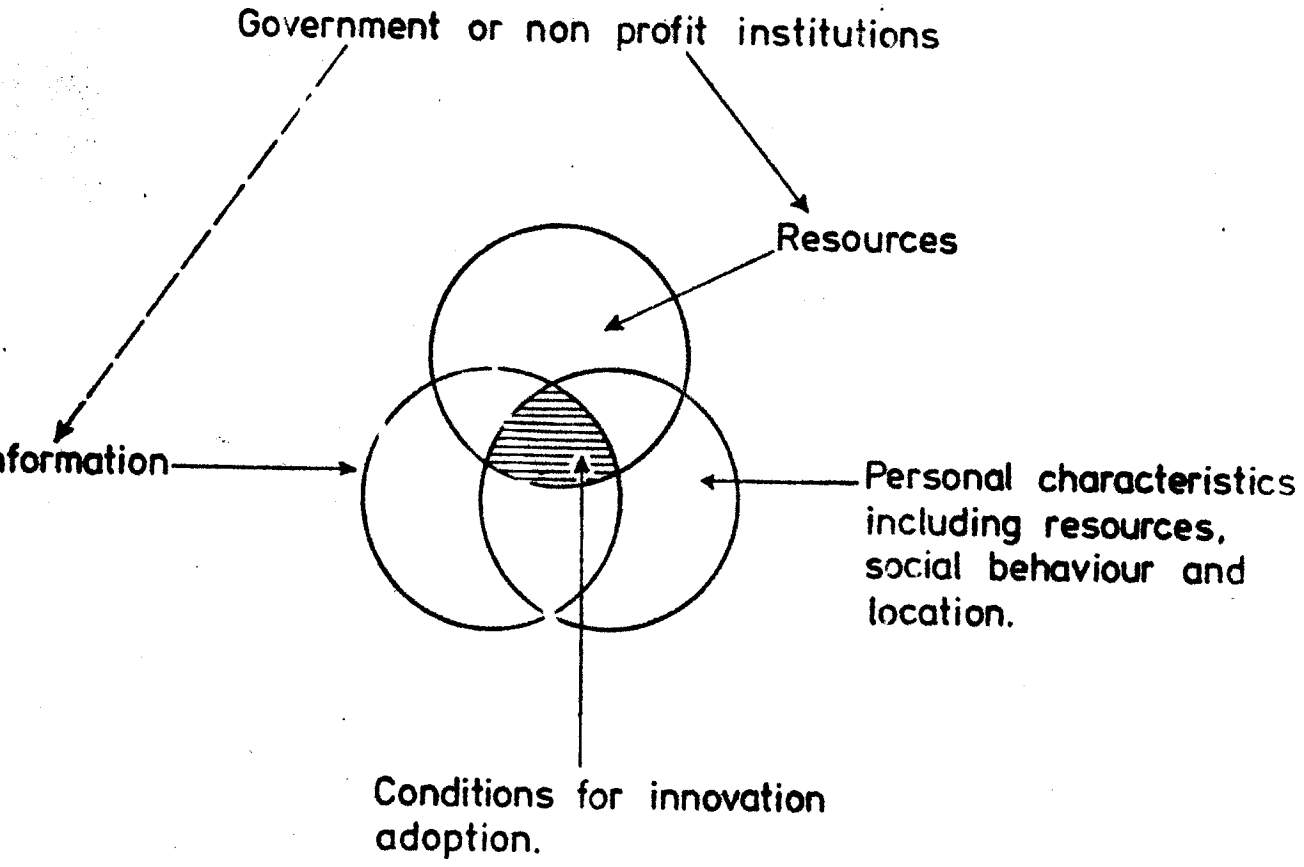
Such resources originating from macro-economic planning, primarily affect non-profit entities which themselves propagate innovation and often serve as an intermediary between government actions and individual or household adoption.

Blaikie (1978) and Yapa (1977) say that innovation adoption is influenced by whether or not the resources and information provided by the government and other institutions, are fairly distributed in terms of the social, political, economical and spatial characteristics of an area. As a result some individuals and households have less chance of adopting an innovation due to their spatial and social isolation from the rest of the individuals or households. Some examples of these social, political, economic and spatial biases of different individuals or households include the bias in the way loans are given to people where those with some social or political status in the society are favoured. There is also a resource base of individuals or household especially in the availability of labour and since most innovations require more labour

those without adequate labour may not adopt certain innovations. The other bias is found in the message of the extension services, where for instance the introduction of technology may be only suitable for much large scale agriculture and not for peasant agriculture.

It can be seen that the conditions for innovation adoption depend upon the presence of three types of ingredients which are personal characteristics, availability of resources and information availability and not just one of these. These ingredients are, however, to be understood in the context of social and political economy that are prevailing. (Fig. 1)

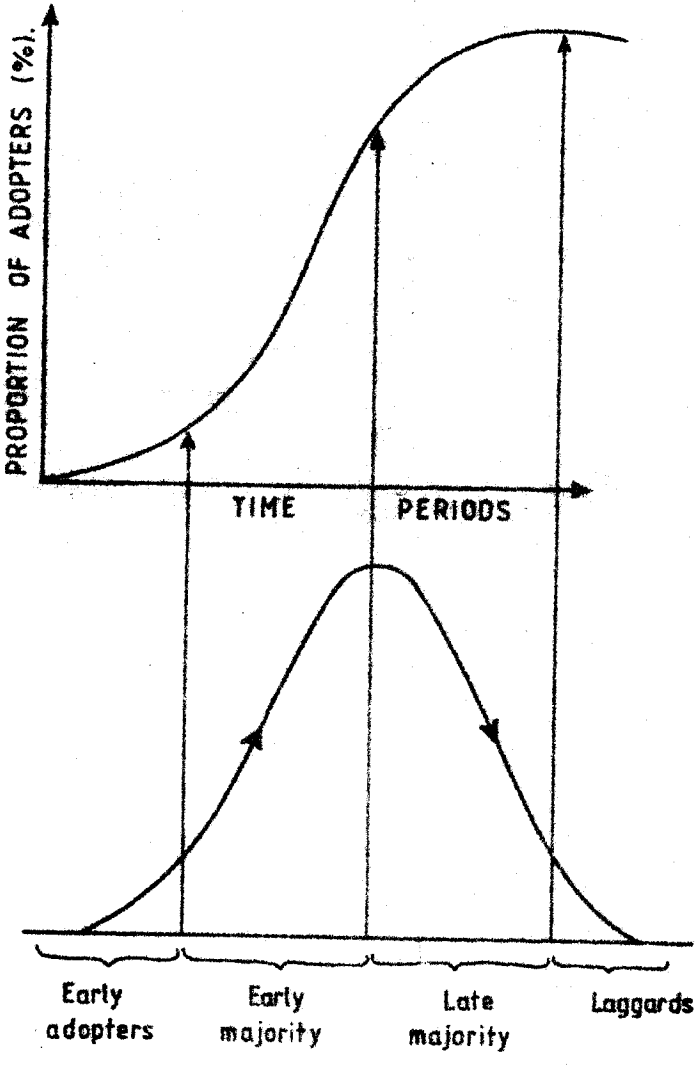
Fig. 1: A view of the innovation adoption and socio-economic characteristics system.



dopted with some modifications from Yapa, L.S. (1977) "Innovation diffusion and economic volution" Antipode Vol.9 p.22.

Hagerstrand (1967) also noted that the cumulative level of adoption over time usually follows an S-shaped curve (Fig. 2). This is due to the fact that the rate of adoption is usually slow in the initial stages as potential adopters consider whether to adopt or not. This, however, increases somewhat rapidly and then slows down later as the few remaining laggards decide to adopt.

FIG. 2: THE DIFFUSION CURVE



1.03 INTEGRATED RURAL DEVELOPMENT (I.R.D.)

The underlying view of rural development in much of the literature has been a neo-classical one. According to this view, rural areas are inhabited by rational farmers, who are held down in poverty by primitive technology, inadequate rural infrastructure and lack of complementary inputs such as fertilizers and other resources including credit. The process of modernizing traditional agriculture was expected to increase agricultural productivity and rural income and set off self-sustaining growth in agriculture which would then be able to provide the resources to be used in industrial development and through increased rural incomes provide a market for industrial products. The focus in rural development policies was firstly the idea of helping farmers overcome technical and institutional problems. Emphasis was, therefore, on delivery system, how to design packages of inputs and how to ensure that they reached farming households.

The failure of this programme to develop rural economies was originally blamed on the poor implementation of such programmes but it was increasingly realised that better adoption of the innovations introduced required an improved information network which would diffuse information concerning the innovations. This led to the combining of the improved packages of innovations and an improved

information diffusion system which led to the development of integrated rural development.

Ahmad (1975, p. 119) defines Integrated Rural Development Programme

> "as a series of mutually supporting (inter-related) agricultural activities orientated towards a stated objective. It involves the progression of rural subsystems and their interaction leading to desired improvements in the rural system as a whole."

Since rural development has been defined as an attempt at improving the living conditions for the rural poor who comprise peasant farmers, tenants and the like, integrated rural development is, therefore, a strategy for planning programmes which may help in making life in rural areas worthwhile for the people living there.

There are a number of components that go in the making of integrated rural development programmes. These components are, however, interrelated with each other and must be directed at the rural poor. An attempt is made below to briefly outline the components of integrated rural development programmes.

1.03.1 Improved farm inputs

Since rural development is designed to improve the economic and social life of people in rural areas, it will usually involve various means designed to raise productivity in agriculture. Agriculture is essentially dependent on soil.

There is, therefore, a great need for rural development projects to improve the productivity of the soil through the

> "introduction of improved farm inputs like fertilizers, improved seeds, various agricultural chemicals, measures to arrest soil destruction through erosion by wind or water and irrigation facilities"

(Holmberg, 1977, p. 11). These inputs and measures will obviously differ from one country to another. One country's priority may be on the introduction of a new type of fertilizers or seeds while another country's priority may be on the control of soil erosion. Usually, however, there is a need to coordinate and combine both input introduction and soil erosion control measures.

Soil productivity may be raised by investigating how best the soil can be used, what fertilizers are suitable for particular soils, which crop may be grown on which soils and the type of implements that are suitable. Integrated rural development projects need the

> "availability of innovations, tested and found to be workable under small scale farming conditions. The development of these innovations should, therefore, constitute the first phase of any such projects" (Ibid).

1.03.2 Agricultural extension services

After research, the next task is to impart innovations to farmers. Usually farmers prefer to use methods and techniques that they trust. They will not take on easily

innovations that differ from their traditional methods. Most peasant farmers in developing countries are illiterate. Extension services, therefore, become a very difficult but necessary task since an extension worker must take to the farmers improved farming methods and new agricultural inputs, and see to it that such techniques and inputs are adopted. Such innovations must be spread in such a way that they reach all farmers in any given area.

Extension services in most developing countries are biased. There are problems of accessibility due to the distances some farmers live from extension centres. Due to this problem, some scholars advocate for the use of model farmers who may act as agents for change and pursuade others surrounding them to adopt new innovations. Such model farmers may be chosen on the basis of income or size of economic operation such as farm size (Cox and College, 1981, p. 132). Such an approach, however, has problems because of the socio-economic distance between the model and peasant farmers which means the peasants may not be so willing and free to learn from the model farmers.

1.03.3 Agricultural loans

Farming is a business and there is no business that can operate without some form of capital. Such capital is needed to obtain inputs and because there is no developing country that can afford to distribute large amounts of

inputs free of charge farmers must pay for the inputs they use to raise productivity. Because of this great need to purchase inputs and because of the fact that most small scale farmers cannot on their own afford the required inputs, agricultural loans become a necessity. Loans become very important in overcoming the naturally slow process of capital accumulation especially to small scale farmers.

The loans could either be seasonal ones catering for the purchase of inputs from planting time to harvesting time, or long term ones catering for the purchase of farming equipment or both. The credit facilities could be handled by some government created institutions. Loans, therefore, help in speeding up capital accumulation and also in overcoming bottlenecks in farming created by resource shortages.

1.03.4 Marketing

With improved farm inputs, better extension services and availability of loans, it is expected that the productivity of agriculture will be raised. Arrangements should be made to the effect that the crops grown are well disposed of and that all the benefits go to the grower. This may infact in turn encourage farmers to grow more crops especially if marketing is being undertaken by some institution such

as a co-operative. If farmers have to bear the cost of marketing themselves individually, increased production may be discouraged or if there is no co-operative or government service then some traders who can afford to buy in bulk and transport the produce over long distances may tend to exploit the farmers.

This may, therefore, call for the establishment of some marketing institutions to carry out the marketing of the farm produce. It is often better in integrated rural development projects for such institutions to be transformed into co-operatives owned by farmers themselves. Such marketing institutions become responsible for purchasing and marketing of produce and also for distributing inputs to farmers.

Marketing of agricultural produce is, however, difficult in most developing countries due to poor feeder roads, many scattered peasant farmers, insufficient financial support from the central government and other bottlenecks.

1.03.5 Employment

Rural areas have a lot of unemployment and underemployment. Both of these, however, vary seasonally. There is more employment during the periods of cultivation, weeding and harvesting,. Unemployment and underemployment can be

reduced by the introduction of improved farm inputs which call for labour being occupied for longer periods in cultivation, weeding, harvesting and marketing of what is produced.

There could also be other measures to reduce underemployment. Such measures may include the establishment of labour intensive small scale industries which could provide employment to the people in the dry season and is also helpful to people with inadequate agricultural resources. Such industries can produce goods for consumption thereby raising the quality of life in rural areas. The introduction of rural public works like the construction and maintenance of feeder roads, bridges, soil control measures and dams for irrigation purposes may also have an impact on both unemployment and also upon production.

1.03.6 Manpower training

Agricultural production and productivity can be raised through a proper education campaign by extension workers. Farmers and their families are given demonstrations as how best to look after their land, crops and on general aspects of improved life and agriculture. Courses not of immediate relevance to agriculture may also be offered. These could include the teaching of illiterate farmers how to read and write so that they are able to read and understand some simple instructions on certain inputs. Children may also

be included in such programmes. This type of training should be based on the people's own experiences and talents, not on things that are too new to them.

1.03.7 Women and Youth

Integrated rural development projects should include women and the young ones as well if they are to have any impact on the development of rural areas. A component of home economics may be included in an effort to develop the domestic skills of women and raise their awareness of matters important to the development of their society (Evans, 1981, Lombard and Tweedie, 1974). This alone, seems to reinforce the women's traditional role in their homes as keepers of the kitchen and the men as the head of the household. It would be useful, therefore, to teach the women those productive skills which are presently dominated by the menfolk. This may help in bringing them into the economic mainstream of life in rural areas.

Young people, most of whom may have spent some years in formal education, but who through no fault of their own could not go further also need some form of vocational training in practical skills suited to their rural life. This may help them to stay in rural areas and use their acquired skills instead of migrating to urban areas in search of employment. It is important to retain young

ones in rural areas because they are more liable to innovate and take risks as compared to old ones.

1.03.8 Roads

One of the greatest problems confronting most developing countries in their rural areas is the poor transport situation. A lot of these parts are physically isolated from the major centres due to their inaccessibility, a direct result of lack of roads. Due to such poor communication networks, improved inputs may not reach the farmers in such areas. Marketing of their produce is also very difficult.

The building of feeder roads connecting rural areas to district and regional centres may, therefore, be an important part of any integrated rural development project for these may help in raising agricultural output and the marketing of both agricultural products and inputs.

1.03.9 Water resources

The availability of water is an important prerequisite to setting up a settlement in any area. Water is needed by man, his animals and plants. In most rural areas, however, people, often women walk long distances in search of water. This, therefore, means loss of labour time and energy. Furthermore, this water in certain cases is of

poor quality and hence contributes to poor health of the people. An improvement in the availability of water through sinking boreholes, construction of wells and dams may greatly help improving rural health, reduce time on fetching water and thereby contributes to increased production.

1.03.10 SUMMARY

For an integrated rural development project to have its impact on the rural areas, it is important that the above mentioned components relevant to an area be combined in each project. In other words, integrated rural development includes all actions required to achieve better living standards in rural areas. It is important to include all these components because it is known that the major causes of rural poverty are interrelated within the framework of both the economic and social systems of rural life.

It is accepted that one component cannot be separated from the whole system without keeping the entirety of the system in perspective. If only one cause of poverty is attacked, there may be some negative repercussions through other causes. There is, therefore, need to attack all causes, otherwise an attack on one could be neutralised by that one which is not attacked. Rural development projects should, therefore, take into account the system of factors that cause poverty in rural areas.

1.04 THE ENTRY OF INTEGRATED: RURAL DEVELOPMENT PROGRAMME (IRDP) IN ZAMBIA'S REGIONAL POLICY.

What is now referred to as the Integrated Rural Development Programme (hereafter IRDP) was originally known as the Intensive Development Zones (hereafter IDZ) albeit with some modifications. The IDZ strategy has its roots in Perroux's growth pole theory. It was adopted in regional development planning in Zambia during the Second National Development Plan (G.R.Z. 1971). It was chosen as a way of remedying the worsening rural-urban inequalities which were a result of the post colonial government's policy which placed emphasis on industrialisation (mainly mining) as a way of national development at the expense of agricultural and rural development.

Even during post independence period, resource allocation in Zambia has tended to favour urban areas. For example, the country's post independence expansion of manufacturing industry remained concentrated in the three provinces along the old line of rail (Copperbelt, Central and Southern). Out of a total of 532 major industrial establishments in 1969, only 8 were not in the said provinces. The Third National Development Plan clearly shows that urban areas have also been favoured in as far as investments in social services are concerned (G.R.Z. 1979, pp. 71 - 80).

This bias towards urban areas in the provision of social services has left many rural areas unserved by government services and facilities as well as by essential marketing outlets. Before the introduction of IDZ, the government had tried other approaches to rural development. Some of these approaches included the setting up of rural service centres, the regrouping schemes, farm settlement schemes, state ranches and the tractor mechanisation unit. All these were set up in an effort to try and reach the rural poor most of whom were quite sparsely distributed throughout the country. It was after these approaches had failed to score any major successes that the IDZ was instituted.

The IDZ concept advocated the concentration of a significant proportion of manpower and financial resources in especially defined areas or growth centres. Each zone was also seen as an instrument of provincial or regional development. The main objectives, however, were to decrease the rural-urban disparity. Each zone was selected on the basis of its evident potential for agricultural production. However, such zones were also required to be situated so as to generate as much spread effect as possible throughout the region.

The IDZ's approach was basically multisectoral in which the agricultural sector had priority. The services provided agricultural extension, marketing, veterinary advice, improved water supply and infrastructure. As second priority were measures for non agricultural sectors such as small scale industry and other social services. These second priority developments were, however, never implemented.

The IDZ strategy was first tested in Chipata district in Eastern Provice in 1972 covering an area of about 12,000 square kilometres. The Chipata district was further sub-divided into six regions for the purposes of concentrating financial, material and human resources within smaller priority areas, as was stipulated under the IDZ policy. The first area to come under this programme was Kalichero followed by Kalunga, Luangwa valley, Chiparamba and Chanje areas. In 1973, the IDZ programme was also introduced in Northern Province with one area programme in Mambwe (Mbala district) and a sector project (coffee) initiated in Ikumbi (Isoka district). Another sector project dealing in rice was later started, in 1975, in the Chambeshi Flats (Kasama district) while the area development strategy was extended to Ikumbi in 1976. These two projects were administered by the Swedish International Development Agency (SIDA). In North Western Provice, the same strategy was implemented in 1977 in Kabompo district by the German

Technical Assistance to Zambia (GTZ).

Because only small areas were covered by the IDZs in most districts, there was general opposition by the Party and its government. As early as 1975, a joint meeting of the Central Committee of the Party and the Cabinet approved the Party and its government's guidelines for the Third National Development Plan (G.R.Z., 1979). These guidelines stated that the concept of IDZ concentrated investment resources in few areas and ran contrary to the philosophy of humanism, which required that development resources should be evenly distributed throughout the country. In 1977, instructions were given to the then Ministry of Lands and Agriculture[1] through the National Commission for Development Planning from the Central Committee to stop any further extension of IDZ and try a modification of the strategy (G.R.Z., 1979, pp. 171 - 172). This modification was effected during the Third National Development Plan when the word Integrated Rural Development Programme (IRDP) was coined. It was found appropriate because the projects were supposed to integrate all the components (already discussed) in an attempt to tackle the causes of rural poverty.

With this modification of IDZ to IRDP, the programme in Eastern Province was gradually extended to cover all districts, but with Chipata as the centre (Mwali, et al 1981, pp. 13 - 14). In Northern Province, IRDP extended

its activities to Shem in Isoka district and Ndasa in Kasama district. The Ikumbi project area was also extended. The British also came in and took up the Serenje-Chinsali-Mpika stretch as their projectarea. In North-Western Province the project extended from Kabompo to the neighbouring districts of Zambezi and Chizera in 1980 covering an area of 48,000 square kilometres.

Under IRDP policy, priority was given to small holders, concentrating in those areas where the physical resource base and the existing human and physical infrastructure were favourable within less developed regions. These requirements were in line with the premises of the growth centres and diffusionist paradigm. The favourable areas that were chosen were to act as growth centres and all efforts were concentrated here. It was assumed that these chosen areas with their new services and advantages over others would act as centres of innovation to which people would voluntarily regroup and from where traits of development would diffuse and spread to the surrounding areas. It was also assumed that the successful farmers within the project area would provide a demonstration to the less successful farmers. This would then lead to the spread effect of agricultural development in the chosen areas. It is this assumed diffusion of development from the growth centre that this paper sets to test.

FOOTNOTES.

1 The ministry responsible for agriculture and rural development changed during the period under study. From the early 1970s to 1977 it was known as the Ministry of Rural Development. In 1978 it became the Ministry of Lands and Agriculture and from 1979 to the present it is known as the Ministry of Agriculture and Water Development.

CHAPTER TWO

THE STUDY AREA, RATIONALE AND METHODOLOGY

2.01 The study area.

This study was carried out among the Namwanga people living in the Nakonde area of Northern Province. The "sub-boma" of Nakonde is located about seventy kilometres north-east of Isoka which is the district headquarters. Nakonde (fig. 3) is located on the border of Zambia and Tanzania. Normally, there are no restrictions for the people who wish to cross either into Zambia or Tanzania for their daily businesses.

Nakonde is at an altitude of about 1580 metres above sea level and has a population of 10,000 according to the 1969 census (G.R.Z. 1974). It is connected to the national transport network by the Great North Road (G.N.R.) and since 1974 by the Tanzania Zambia Railway (TAZARA).

Ikumbi is an old traditional name for the area which is now known as Nakonde. When a name was, therefore being sought for the new IRDP project in this area, the IRDP personnel in collaboration with the local leaders opted for Ikumbi in an effort to try to encourage the traditional unity of the area. Nakonde and Ikumbi, therefore, refer to the same area although Ikumbi basically includes a wider area with more small villages than does Nakonde.

2.02 ENVIRONMENTAL BASE OF IKUMBI PROJECT AREA.

In the Ikumbi project area, most soils are those of the red clay and sand veldt categories (Brammer, 1976, p. 20). The characteristics of red clays are that they are well drained with mainly a dark red colour in both the top soil and subsoil layers. These soils become moderately well to imperfectly drained when they are browner or have brown, yellow and grey mottles in the sub soil. These soils are usually deep. There are also various kinds of sand veldt soils, but almost all types have in common a sandy top soil overlying a more clayey subsoil. However, in the Ikumbi project area, the major sub group found is the moderately leached sandveldt soils which are mainly concentrated in areas with over 1,000 mm. of rainfall. These soils may be acidic, but this may be controlled by liming (Brammer, 1976 and Mansfield, et al, 1975). They are also usually deep and most fruit trees flourish on such soils.

Generally, the terrain in the area ranges from 1300 to 1580 metres in altitude. Data on temperatures in this area is not readily available. Data for Mbala may, however, suffice since it has more or less the same climatic conditions as those in the project area under study. Mbala has a monthly mean temperature of 68 degrees Farenheit in June the coolest month and 75 degrees Farenheit in October the hottest month (G.R.Z. 1969, Fig. VI). The rainy season usually begins in November and ends in April.

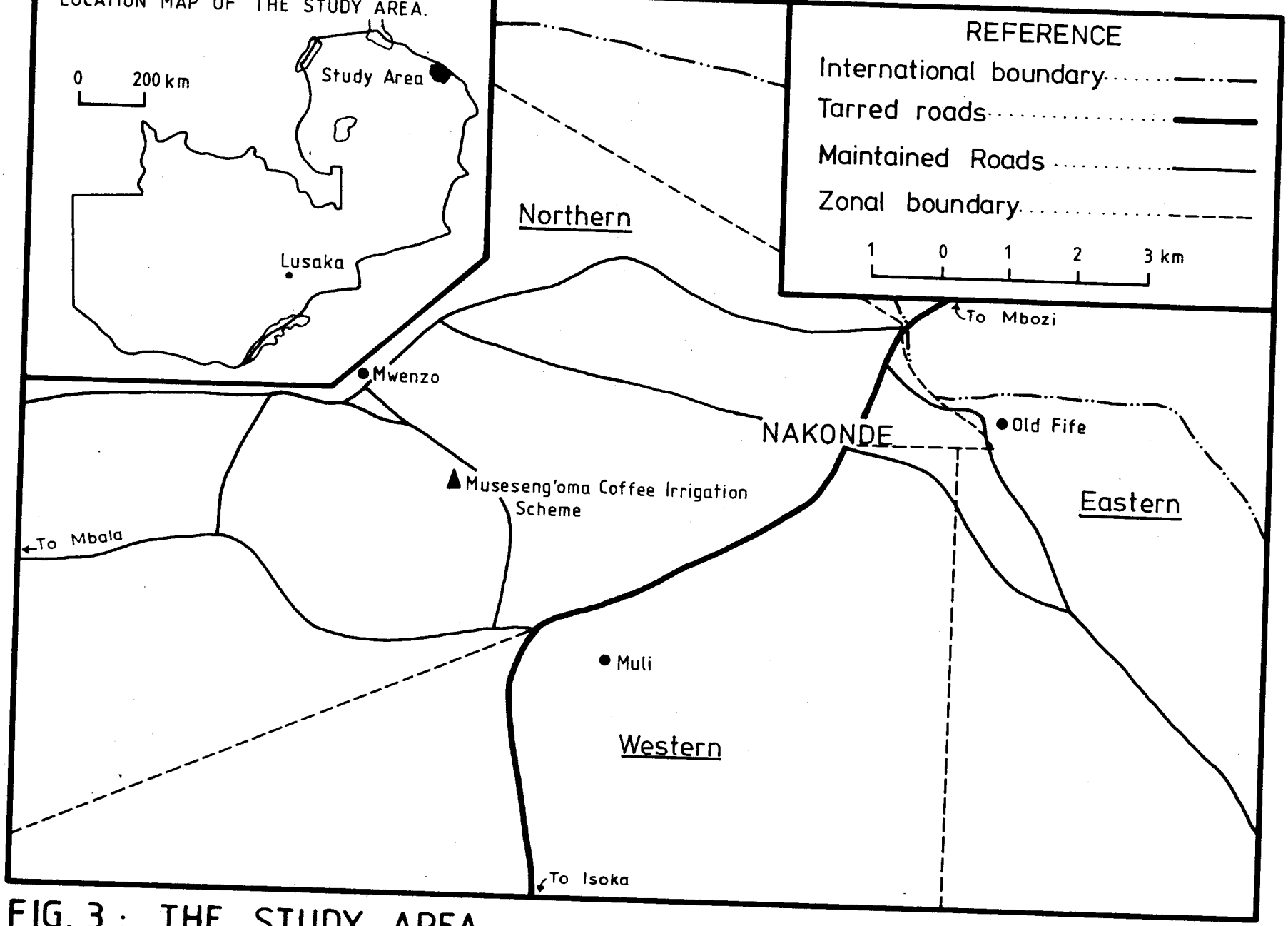


FIG. 3 : THE STUDY AREA

Rainfall ranges between 900 and 1,000 mm. per year and the mean duration varies from 150 to 195 days. The climate in the area is, therefore, favourable to many varieties of annual crops with a long growing season.

> "From December to March dry spells in excess of five days are rare, so drought is not considered to be a threat except where soils have a very low available water capacity".

(Mansfield, et al., 1975).

The topography in this project area can be described as gently and evenly sloping. Such topography is good because soil erosion which could be a menace on land with steep slopes is limited. This allows top soil to remain in place and for deep soils to develop which are advantageous to plants like most tree crops including coffee which require a deep rooting zone.

2.03 RURAL ECONOMY IN IKUMBI PROJECT AREA

There have been vast changes in agriculture in Ikumbi, but traditional food systems have undergone little or no change at all. Most households are still self sufficient in major foodstuffs. People in Ikumbi still depend on their traditional food economy. The traditional food economy includes the grain crops of fingermillet, maize and sorghum, rootcrops of cassava, sweetpotatoes and Livingstone potatoes which are also grown. Beans are the major relish grown in

addition to a variety of vegetables. There are no big rivers and hence fishing is not an important activity. All grain crops including the root crop of cassava are used for making nshima which is the staple food in the area.

Cash crops as it will be shown later have been introduced leading to a change in emphasis within the largely traditional farming systems. The modern emphasis on cash crops like maize, coffee, beans and wheat has, however, not changed most households' dependence on their own production for much of what they eat. Nonetheless, cash cropping is becoming very important as increasing dependence on market goods grows and expansion of desires and expectations continues. Some households also keep some livestock like cattle and goats, but here unlike in other areas where cattle are kept, they are not used for ploughing.

Although some cash crops have been introduced in the area, farming here is basically a subsistence activity and most of the produce is consumed by the household. Some agricultural produce is, however, sold to local markets by some households. E ssentially, any crop that is in surplus may be sold, but maize is the major crop sold. This may be sold to the Northern Province Co-operative Union (N.C.U.) or even to other individuals within the area. Traditional beer is brewed from fingermillet and

there is a local trade in this.

Agriculture in the area is almost completely unmechanised. There are two tractors owned by the Land Development Services Unit of the Ministry of Agriculture and Water Development which are hired by farmers. These tractors cannot be relied on because they are broken down most of the time and also that considering the number of people who would like to use the tractors, they are too few to be hired out without causing any delays. It is, therefore, not uncommon to find that some farmers pay for the tractor service in December, but may not have their fields cultivated until February causing a lot of delays and inconveniences. Tractors are also too expensive for most people in the area. The majority of fields are, therefore, hand cultivated using the hoe, axe, machetes and other similar implements. Harvesting is undertaken completely by hand. In the coffee fields, the clearing of forests, digging of holes and planting is also carried out manually.

Most agricultural work for most crops is carried out during the rainy season, from November to April. Harvesting and storage is usually undertaken from July to August for most annual crops. Cassava, a major food crop in the area is not harvested during the first year, but must wait until the third or fourth year when it is ready for harvesting. During peak working periods like cultivating

and weeding, there may be some shortage of labour locally but this is often offset by using labour from neighbouring Tanzania which is often easily available. Shortage of labour is, therefore, not considered as a major constraint on farming provided farmers generate enough cash to pay them.

The unit of residence and the primary unit of production is the household.[1] However, the individual families of an extended family group frequently live in neighboring villages and may help one another. This is particularly true in cases where intensive work over a short period of time is required such as during planting and harvesting. In a Namwanga household, children start at an early age to become an important part of the economic enterprises. As early as the age of seven years, children, especially boys, will start to help with herding, albeit at this young age, they do not usually go far from home alone. Namwanga children start helping with the actual agricultural work at the age of nine or ten years.

Among the Namwanga, there is division of labour according to sex with men doing most of the hard work in agriculture. In addition to household duties, women select and prepare most of the seeds and do the sowing in ridges prepared by the menfolk. Women also take a major share in weeding and harvesting. Things are different when it comes to

growing coffee where most work is done by men, except for weeding and picking of cherries where women join in. Women are also responsible for much of the marketing of family produce except where the surplus is a lot when the man takes over.

2.04 IKUMBI IRDP PROJECT

In 1973, the Provicial Development Committee selected an area for an I.D.Z. project. This area was a triangle with Kasama, Mbala and Nakonde as the three corners. These three towns were to be centres of three I.D.Z. project areas. They were chosen on the basis of various opportunities and potentials which were thought to exist in the area especially for the development and production of certain cash crops. These opportunities and potentials called for two types of development approaches namely, the area programme approach and the sector project approach.

The area programme approach emphasised the implementation of a coordinated range of development measures, including a series of innovation packages supported by a service programme, for example the giving of improved seed and lessons as to how this can be sown by extension workers. The sector project approach put much emphasis on the improvement and production of a single cash crop, hence in Ikumbi emphasis was on coffee, although wheat was later introduced.

During another ProvincialDevelopment Committee meeting in 1974, it was approved that the first area project should start in Fwambo-Mambwe area in Mbala District to be followed by the Ikumbi area in Isoka District. It was further approved that the first sector projects should start with small scale coffee production in the Ikumbi area and rice development in Mulema area.

These areas were chosen essentially on the basis of population density. Mambwe and Ikumbi had 22 and 17 persons per square kilometre respectively. The average for the whole province was 4 persons per square kilometre. The chosen areas were, therefore, those where the services provided by I.D.Z. could service the maximum number of people with the minimum cost.

In the Ikumbi I.R.D.P. project area, the planners expected development to come about by the concentration of a significant proportion of man power and financial resources around the project area, then there would be trickling down of development to the surrounding areas. Each project area was, therefore, seen as an instrument of provincial or regional development. Through this process, it was hoped that the disparities between regions would be decreased.

The major emphasis in this project area was on small-scale farmers, and on overcoming the constraints upon their development. This is important because small-scale farmers constitute the majority of the population in this particular area. Firstly, only small-scale coffee producers were considered, but other crop producers were later also considered. I.R.D.P. in Ikumbi project area, therefore, provided extension services and inputs in appropriate small sizes to small-scale farmers and helped with marketing of the produce by constructing marketing sheds. The elements of extension services, provision of inputs and the promotion of marketing facilities were all seen as part of an integrated, unified system meant to help the rural poor.

Another activity that the I.R.D.P. was engaged in in Ikumbi project area was in the improvement of the feeder road network in the area. This is important because of its relationship to the question of improved supply of inputs and marketing facilities. There was also a component dealing with the provision of clean water to the people by sinking boreholes. This was seen to be one way of improving the health of the people so that all their energy would be used in productive work. The whole of this work in this project area was undertaken by three extension workers employed by IRDP who were directly answerable to the coordinator of IRDP based in Kasama.

On the whole, therefore, it would seem that the programme in Ikumbi project area forms a unified, closely integrated system, and is in line with the needs of the area.

2.05 RATIONALE FOR THE STUDY

The I.D.Z. programme was introduced in Ikumbi area in 1974. The emphasis was on small-scale coffee growing and the introduction of small-scale wheat production. Other components conducive to rural development were also introduced.

Despite the introduction of the I.R.D.P. in the Ikumbi area with the already described objectives, agriculture in the area especially the small-scale coffee and wheat production cannot be decribed as successful. Furthermore, the benefits that are supposed to be enjoyed by the local people as a result of the I.R.D.P. activities are more apparent than real. There has been very little trickling down effect of development from the areas and points where it is supposed to spread from.

Very few farmers infact express satisfaction at the way the IRDP is trying to encourage coffee growing in the area. This is further proved by the number of farmers who were pioneer coffee growers who are no longer growing the crop but have instead switched almost completely to maize

growing. Another crop of emphasis on a small-scale basis was wheat which was introduced by the I.R.D.P. which cannot be described as successful either. It remains to be seen, therefore, how far the IRDP ambitious objectives have been translated into practice and how its major goal of reaching the largest possible proportion of the people to stimulate a general improvement of living standards has fared.

In view of these objectives and the limited success reported by the IRDP, this study sought to investigate the general impact of the programme on the local people.

The terms of reference for this study were to:

(a) identify the spatial variations through time in the participation of people in marketed agricultural production, with coffee and wheat as the principal indicators. This identification is to take the form of adoption by households of innovative practices of growing the said crops.

(b) attempt an identification of the facilitating and constraining factors in the diffusion process. These may be the socio-economic characteristics of the people, the physical features of localities or the infrastructure of the area.

2.06 METHODOLOGY

In order to carry out this study on the Ikumbi IRDP project area, three major methods were used. These methods were:

(a) archival research,

(b) field survey of households in villages in the project area,

(c) structured and unstructured interviews with staff of IRDP, Ministry of Agriculture and Water Development and other key informants.

Prior to field research, the author undertook archival research utilizing other studies, reports and already collected material. These were consulted in the University of Zambia Library, the offices of the Ministry of Agriculture and Water Development (especially the IRDP section and the Department of Crop Husbandry in Mulungushi House, Lusaka), IRDP offices in Kasama and Nakonde, the office of the District Agricultural Officer in Isoka and the office of Northern Province Co-operative Union (N.C.U.) in Nakonde.

The rest of the study was undertaken in phases. In the first phase which dealt with the plotting of the distribution of households in the project area, the Central Statistical Office (C.S.O.) Lusaka provided a base map

which had been used during the 1980 census for the study area. This was, however, supplemented with the author's own census to try to make adjustments for the movement of households between the census and the intervening period. Through this method, therefore, a map showing the distribution of households in the project area was drawn.

The second phase involved the plotting of the households who had adopted coffee from 1974 to 1981 and wheat from 1977 to 1981. This was done by using the base map showing the distribution of households, and then using a records book kept by staff at Old Fife which clearly shows when each farmer started growing the crop, how many trees he started with and his location in the project area. With further field surveys, therefore, and these records, it was easy to find the adopters' location. After this identification of the households that adopted, they were differentiated on a map from the rest of the households.

During the last phase, data and information pertaining to the personal characteristics of the people was obtained by means of interviews with the heads of the households. This involved the design of interview schedule, translating questions from English to Namwanga the local language and administering the schedule. A total number of 41 adopters and 60 non-adopters were interviewed out of about 1,000

households. Out of these, about 360 are adopters and 600 are non-adopters. The interviews were done by zones (Table 2.01). The methods of sampling took the form of interviewing approximately every tenth household in the northern zone, and every sixth in the eastern and western zones. These figures were arrived at by using the total number of adopters per zone and dividing this by the intended number of questionnaires per zone.

Table 2.01 Distribution of households by zone

	Northen zone	Eastern zone	Western zone
Total number of households	455	186	314
Adopted house holds	195	74	88
Non-adopted households	260	112	226

During the interviews, however, it was found that some household heads were not present, in which case, the next household was picked and the same procedure was followed thereafter.

Structured and unstructured interviews were also carried out with other key informants like those who belong to the Ikumbi Coffee Growers' Association and the IRDP personnel in Nakonde. Much information was also obtained from the author's personal observation in the area during his field-work.

FOOTNOTE

[1]In this discussion, a household has been defined as a group of people who normally eat and live together. Sons and daughters with their families were also counted as a part of the household if they lived in the same house or group of houses belonging to the head of the household even if they lived and ate in separate rooms. The reason was that the head of the household included them in his household when he was interviewed. He regarded them as being under his authority. According to this definition, therefore, a polygamist has one household if his wives eat and live together. There were some examples of that, but it was more common that the wives had separate households and that the husband alternated his residence amongst them. In this case, they are counted as separate households.

CHAPTER THREE

AGRICULTURAL INNOVATION IN IKUMBI IRDP PROJECT AREA

3.01 HISTORY OF COFFEE GROWING IN IKUMBI

Efforts were made to grow coffee in the then Northern Rhodesia from a very early date. The first experiments were by the British South African Company at Chilanga (a few kilometres from Lusaka) before 1914. This was a failure (Harkema, 1972). The second attempt was by some European farmers in Mbala district after the First World War. Mbala is about 190 kilometres from Ikumbi area. There was some success here, but coffee growing stopped during the Second World War due to a variety of problems which included a spell of inadequate rainfall, poor methods of controlling pests and the difficult marketing system.

Coffee growing was introduced in Ikumbi in the 1950s. In 1954, the Department of Agriculture opened an agricultural station at Old Fife and a coffee nursery at Muli within the Ikumbi area (Fig. 3). At this nursery were two agricultural assistants from Mbozi, Tanzania which is about 37 kilometres from Ikumbi. These agricultural assistants played an important role in disseminating knowledge about coffee cultivation and in encouraging farmers to adopt coffee growing. Ikumbi was chosen for

coffee growing basically because of the good soil and reliable rainfall, but the fact that coffee was growing successfully only about 37 kilometres away at Mbozi was also important.

Despite these favourable conditions, problems were encountered in maintaining the Muli nursery and it was closed in the late 1950s. Some of the problems that led to the failure of the nursery included poor maintenance due to inexperienced workers and diseases due to limited stocks of insecticides and pesticides. However, despite the closure of the nursery, a Coffee Growers' Co-operative was formed in 1958 by the indegenous people of Ikumbi who by then had taken up coffee growing. It is not known whether this was initiated by the colonial government or by the missionaries. The co-operative was basically established to try and find solutions to some of the difficulties faced by coffee growers. The main problems were difficulties in obtaining inputs and poor marketing facilities which had always afflicted coffee farmers in this area. The later problem resulted from the absence of a market for coffee in the then Northern Rhodesia. This meant that coffee had to be taken by road to Moshi in Tanzania for further processing before being sent via Dar-es-salaam to London where it was finally marketed. It can, therefore, be seen that there were basically two setbacks to early coffee

production. Firstly, was the failure of the nursery after just a few years in operation, and secondly the poor marketing system for those who had mustered enough courage to venture into coffee production. The consequences of these setbacks were that very few people continued growing coffee.

In the 1960s, another coffee nursery was established at Old Fife about 9 kilometres away from the old site at Muli. In 1965, a small processing plant was established by Coffee Growers's Co-operative. This was located at Muli, the old site of the nursery which was the main concentration of local coffee growers who numbered about seventy at that time, although only twenty seven were producing coffee for sale (Harkema, 1972).

Although coffee growing by Africans in Ikumbi was encouraged by the missionaries and colonial government during the 1950s, Africans were not allowed to grow more than 50 trees. This idea probably came from neighbouring Tanzania where at first Europeans were completely opposed to Africans growing coffee (Knight, 1974). It was argued by Europeans that Africans were not capable of looking after the crop and that this would lead to disease outbreaks which could spread to their farms too. It can also be argued that Europeans feared for their own labour supply, as if Africans grew their crops

for sale would not need to work on Europeans' farms to obtain cash for tax and consumption purposes (Knight, 1974). However, this resistance by Europeans, did not last long in Zambia, hence the allowance for Africans to plant 50 trees which was later surpassed by many farmers both in Zambia and Tanzania.

Coffee production has, however, continued to face problems. Input provision and support services have been poor. For example insecticides, pesticides, equipment for spraying and pruning have often not been available, while services especially to new small scale farmers have been poor, while the marketing system has often involved a long delay before farmers can get payment for their produce. These are some reasons why the IRDP decided to help small-scale coffee farmers. The IRDP concentrated on three measures which were the introduction of irrigated coffee, the improvement of dry land coffee and the improvement of the extension services.

In 1974, an irrigation scheme was started at Museseng'oma (within Ikumbi) with 48 farmers each cultivating 0.25 hectares. Both the number of farmers and each farmer's hectarage were planned to be increased as time went on depending on the success of the first farmers. The IRDP was responsible for laying all the irrigation infrastructure at this scheme. All the seedlings and other related inputs

were also to be supplied by the IRDP. For those farmers not in the scheme but scattered all over the project area with dry land coffee, the IRDP supplied them with free seedlings and fertilizers in their first year after which they had to buy these. As a result, most farmers with dry land coffee were encouraged to enlarge their plots while others started to upgrade their more or less negleted plots. This same provision of free inputs for one year was also given to the farmers who formed the irrigation coffee scheme. The IRDP extension service package included the holding of workshops and demonstration exercises with the farmers. Field visits were also conducted so that farmers could be taught how to apply certain inputs and also to allow the IRDP staff to get to know the farmers' problems.

The IRDP sought to overcome resistance to coffee adoption by potential adopters by providing repeated contact with those who had already adopted the crop and also by advertising the benefits that the IRDP package was offering to small-scale farmers. The perceived benefits of growing the crop increased in most peoples' minds especially when the IRDP was meeting most of the financial burdens of coffee growing by providing free seedlings and heavily subsidising fertilizers, insecticides and pesticides.

3.02 HISTORY OF WHEAT GROWING IN IKUMBI

Wheat is a very new crop in Ikumbi having been introduced by the IRDP. It was introduced in 1976 on an experiemental basis with only 7 farmers participating. The purpose of starting wheat growing by the IRDP was to try and add another grain cash crop to those already grown in the area and to increase rural income through such sales.

The IRDP started by choosing certain specific locations and farmers within the project area where wheat was to be introduced. The choice of localities and farmers was not very sophisticated in that they were chosen on the basis of favourable soils and frost free areas and then by choosing people who appeared to have more potential as farmers because of their previous yields in other grain crops.

The chosen farmers were given seeds and fertilizers free of charge and taught how to grow the crop. It was hoped that as these pioneer farmers became more established, they would be left on their own as model farmers and that the idea of wheat growing would diffuse from them to other people in the vicinity. Hence pioneer farmers were to demonstrate to their neighbours how best to go about growing wheat with the minimum help from the trained extension workers. The harvested crop was to be marketed by the Northern Province Co-operative Marketing Union (N.C.U.).

3.03 THE EFFECT OF DISTANCE DECAY ON THE ADOPTION OF COFFEE AND WHEAT

To study the effect of distance from the innovation centre on the adoption process, the whole project area was divided into zones of 2, 4, 6, 8 and 10 kilometres in radius from Old Fife, the innovation centre. The number of households within each of the six zones were counted and the adoption rate for each distance zone calculated (see Fig. 4a and 4b and Tables 3.01 and 3.02.)

When considering the adoption of coffee and wheat, it was hypothesized that there would be an inverse relationship between distance from the growth centre and the rate of adoption since there are few topographical variations in the zones.

In the whole of this study, Old Fife was taken as the innovation (or growth) centre for the whole Ikumbi IRDP project area. This is because it is at Old Fife that the agricultural station is located. This is the distribution point for information, agricultural inputs like seeds, fertilizers, insecticides and other related services. The coffee nursery is also located here. Furthermore, all extension workers operate from here. Consequently, it may be assumed that all agricultural innovation and the spread effects of any extension efforts start from here.

Table 3.01: Distribution of coffee farmers in relation to distance from the innovation centre for 1979*

Distance in KM.	Number of adopters	Total households	Per-centage of adopters to tot households
0 - 2	21	80	26.3
2 - 4	30	204	14.7
4 - 6	42	180	23.3
6 - 8	26	159	16.4
8 - 10	31	209	14.8
10	16	123	13.0
TOTAL	166	955	17.4

* 1979 was used because it was the peak year for coffee adopti and hence makes a good year to compare the adoption rate per each distance zone.

The pattern of adoption of coffee by distance zones fits the general hypothesised pattern quite well with the exception o the second distance zone. There is a steady decline of adopters as distance from the growth centre increases. The deviation from the hypothesised pattern especially in the second distance zone might have come about as a result of the location of some earliest coffee farmers who may not have used Old Fife as the only growth centre - (but may be used Muli instead which is in the second zone).

The wheat adoption pattern fits very well with the distance decay model (Table 3.02). There is a very striking decline in the rate of adoption as distance from the growth centre increases. There was a 45 per cent adoption rate in the first distance zone which decreases to about 14 per cent in the third distance zone through to about 7 per cent in the last zone. Wheat fits so well in this pattern because the crop is new and its only source of adoption is Old Fife. This means that the influence of the present innovation centre is paramount as it is the only source from which inputs and information have come, a situation different from that of coffee.

Table 3.02: Distribution of wheat farmers in relation to distance from the innovation centre for 1979

Distance in KM.	Number of adopters	Total households	Per centage of adopters to total households
0 - 2	36	80	45.0
2 - 4	47	204	23.1
4 - 6	25	180	13.9
6 - 8	19	159	12.0
8 - 10	12	209	5.7
> 10	9	123	7.3
TOTAL	148	955	15.5

Overall, therefore, it can be concluded that distance has a considerable influence on the rate of adoption of an agricultural innovation, despite the fact that in this study, coffee adoption deviated slightly from the hypothesised pattern for the reasons that have already been given.

The influence of distance from the innovation centre is probably a result of the fact that households closer to the innovation centre are more likely to get information from the agricultural and other institutional agents based there who in most cases have acute transport problems and hence cannot travel far afield. Households closer to the growth centre are also able to transport any available inputs more easily to their homes using their heads, wheelbarrows and bicycles as their modes of transport than farmers further away. It is also easier for them to transport their produce to the depot at Old Fife. Such a task becomes very tiresome further away from the innovation centre.

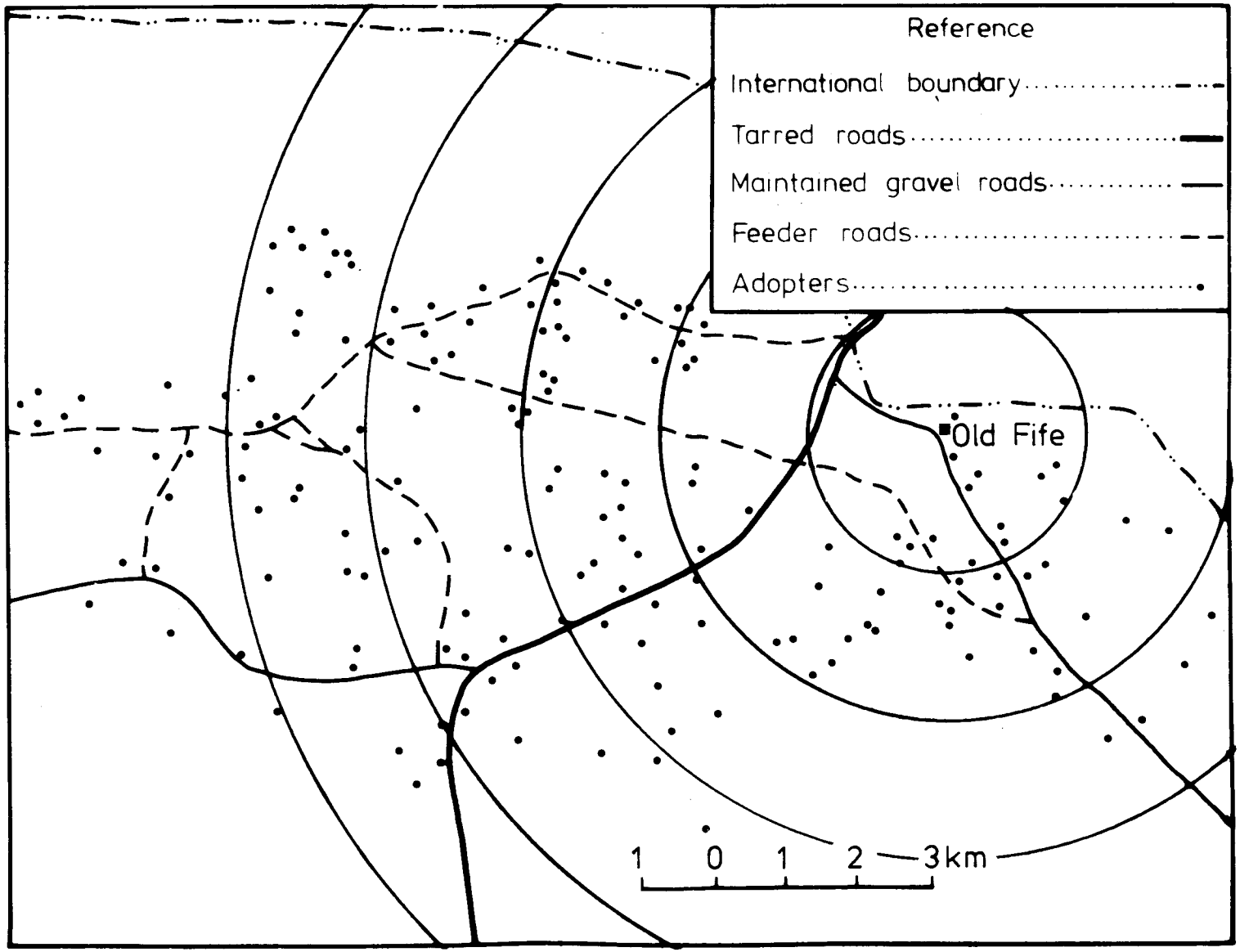


Fig. 4a : DISTANCE DECAY MAP FOR COFFEE FOR 1978.

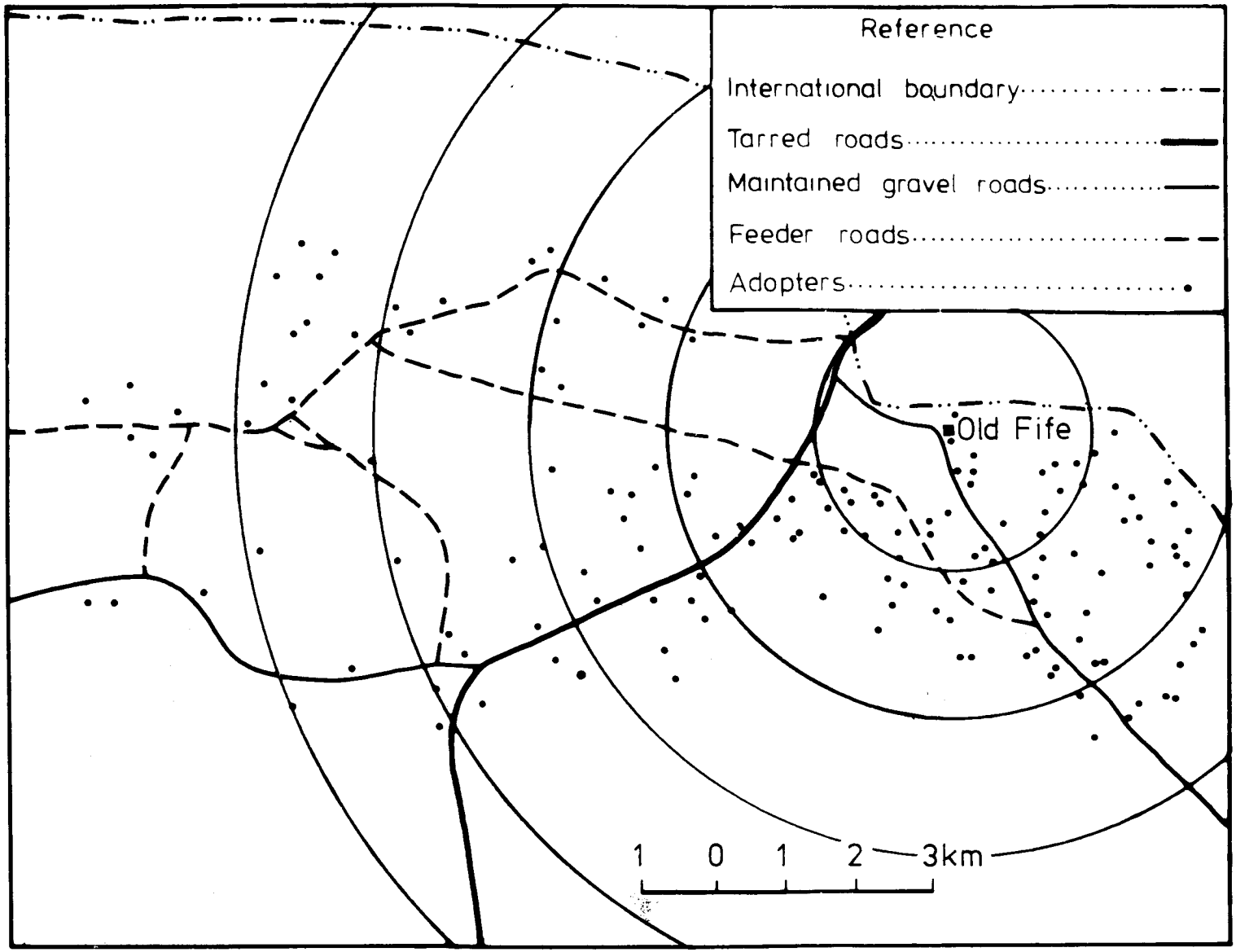


Fig. 4b : DISTANCE DECAY MAP FOR WHEAT FOR 1979.

3.04 TEMPORAL PATTERNS OF AGRICULTURAL INNOVATION IN THE PROJECT AREA

This section looks at the process of cash crop adoption as it is manifested through space and time. The two crops, coffee and wheat are used as indicators of innovation diffusion achieved by the IRDP. This in turn is indicative of the success or failure of the IRDP in enhancing rural development.

At the time of research formulation, it was suspected that at the project area level of aggregation a strong correlation would be found between the time period since the crop was introduced (wheat) or supported (coffee) and the number of households adopting the crop. A degree of similarity was found in Ikumbi in the pattern of adoption of both coffee and wheat and this accords with the general model of agricultural innovation over time. However, deviations from this model have been growing in recent years (Tables 3.03 and 3.04; Fig. 5 and 6)

Table 3.03: Coffee adopters/dropouts for the period 1973 to 1981

YEAR	CUMULATIVE TOTAL NUMBER OF ADOPTERS	BALANCE OF NUMBER OF NEW ADOPTERS/ DROPOUTS/YEAR	CUMULATIVE % OF TOTAL FARMING POPN. WHO HAVE ADOPTED	TOTAL HECTARGE OF COFFEE	COFFEE PRODUCTION IN TONNES
1973	35	35	3.7	*	*
1974	54	19	5.7	35	1.7
1975	107	53	11.2	45	2.8
1976	149	42	15.6	48	4.2
1977	149	0	15.6	52	2.0
1978	166	17	17.4	67	3.0
1979	155	- 11	16.2	60	3.2
1980	120	- 35	12.6	50	2.8
1981	118	- 2	12.4	55	2.8

Table 3.04: WHEAT ADOPTERS/DROPOUTS FOR THE PERIOD 1977 TO 1981

YEAR	CUMULATIVE TOTAL NUMBER OF ADOPTERS	BALANCE OF NUMBER OF NEW ADOPTERS/ DROPOUTS PER YEAR	CUMULATIVE % OF TOTAL FARMING POPN WHO HAVE ADOPTED	WHEAT PRODUCTION IN BAGS
1977	7	7	0.7	1.4
1978	83	76	8.7	17.1
1979	148	65	15.5	30.5
1980	137	- 11	14.3	28.2
1981	110	- 27	11.5	22.7

The adoptors of wheat follows an almost identical pattern to that of coffee (Fig. 5 and 6). Only 1 per cent of the households grew wheat in the year of its introduction, 1977. Thereafter, there was a striking rise to about 16 per cent in 1979. Since then there has been a gradual decline to about 14 per cent in 1980 and 12 per cent in 1981. In the case both coffee and wheat, there is no marked variations in the number of households adopting the innovation per year.

At the introduction of the IRDP in 1974, there were many potential adopters of coffee but they had different degree of resistance. This resistance was a result of what the potential adopters perceived as being the disadvantages and bottlenecks of coffee growing in the area. these included lack of money for the general requirements of coffee growing like land clearing, purchase of seedlings and other related inputs, the sophisticated way of looking after coffee, the period a farmer must wait before any harvest can be forthcoming and the poor extension service provided (Sinkala, 1981).

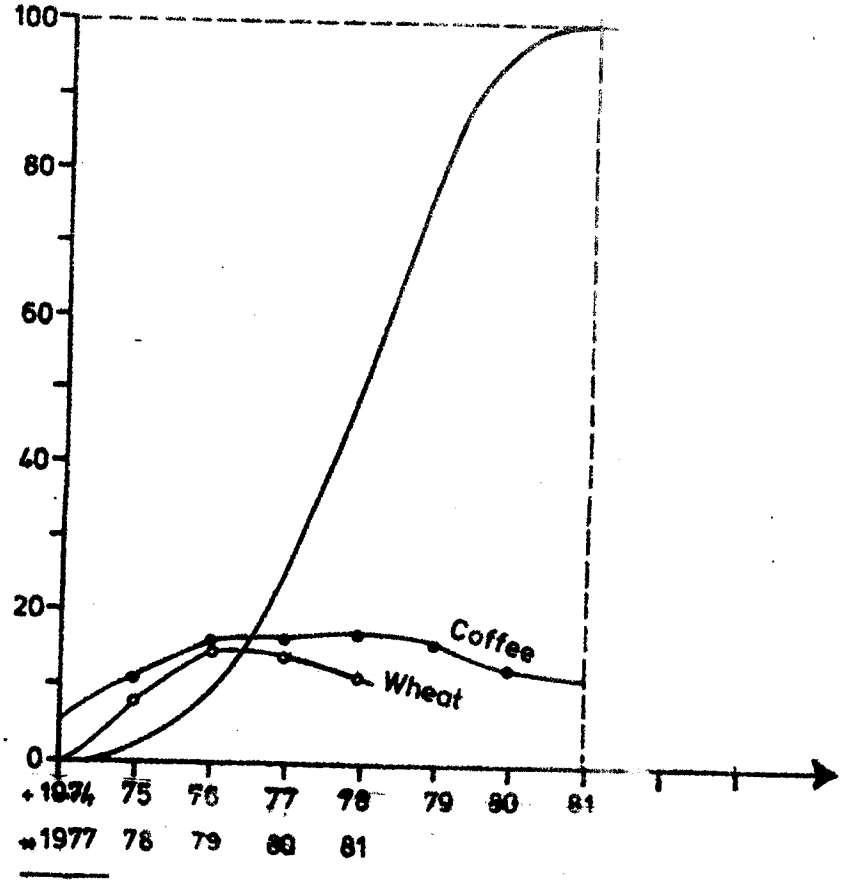
Wheat on the other hand did not meet with so much resistance because although new in the area, it is an annual grain crop. Hence it was accepted as any other grain crop like fingermillet, maize and sorghum which

are the staple crops and like them it was expected to be relatively easy to grow. Because of this, and also because of the IRDP's free distribution of seeds and other inputs, the rate of adoption for wheat was higher than that for coffee.

The deviations from the theory of innovation with its S-shaped adoption curve could be attributed to the inappropriateness of the packages which were given to the people. The free seedlings in the case of coffee and seeds in the case of wheat and also the free inputs given to the farmers did not encourage farmers to be self reliant. In fact it can be said that farmers were almost bribed to start growing these crops. Consequently, when the IRDP stopped giving its inputs freely, many farmers could not stand on their own feet and hence stopped growing the crops.

The turn around or the decrease of adopters is, however, much more pronounced in coffee than in wheat basically because of the collapse of the Museseng'oma irrigation scheme which almost all of a sudden "dropped off" about 40 farmers whereas the drop for wheat growing was somewhat gradual.

Fig. 7: Hypothetical adoption curve superimposed with coffee and wheat adoption curves.



+ 1974-81 refers to coffee.
* 1977-81 refers to wheat.

3.05 SPATIAL PATTERN OF INNOVATION FOR COFFEE AND WHEAT BY ZONE.

In an effort to try and cover the whole project area as efficiently as possible extension workers divided the whole area in three subareas which they referred to as zones. These are the Northern, Western and Eastern zones (Fig. 3). Looking at these zones closely, it is noted that there are some differences amongst them in terms of population and its distribution, accessibility and other environmental characteristics. The Northern zone

has the highest population of about 455 households most of whom are situated along the roads and the already established villages like Mwenzo and Museseng'oma. The Western zone has about 314 who are scattered all over the area. The Eastern zone has the least population with approximately 186 households located mainly along the available roads. The most accessible zone is the Northern one with an accessibility index of 1.2 while the Western zone is the least accessible with an accessibility index of 3.6 and the Eastern zone has an index of 2.2.[1]

On the environmental aspect, there are no major differences among the three zones. Slight differences may be found in the type of soils especially in river valleys and dambos. Hence certain soils found in certain areas may be more suitable for a particular crop. For example river valleys and marshes are bad for coffee because of frosts. However, these difficult conditions are almost evenly distributed across the area.

Table 3.05: Distribution of cumulative number of coffee adopter/dropouts by zone per year.

YEAR	ZONE									TOTAL
	WESTERN			EASTERN			NORTHERN			
	a	b	c	a	b	c	a	b	c	a
1974	12	22.2		8	14.8		34	63.0		54
1975	27	25.2		17	15.9		63	58.9		107
1976	30	20.1		25	16.8		94	63.1		149
1977	30	20.1		25	16.8		94	63.1		149
1978	32	19.3		29	17.5		105	63.3		166
1979	30	19.4	32.9%	28	18.1	19.5%	97	62.6	47.6%	155
1980	23	19.2		19	15.8		78	65.0		120
1981	23	19.5		19	16.1		76	64.4		188

Notes:

a Cumulative number of adopters

b Per centage of total cumulative number of adopters of area in the zone

c Per centage of total area population in the zone for 1979, which was the peak year in coffee adoption

Table 3.06: Distribution of cumulative number of wheat adopters/dropouts by zone per year

YEAR	ZONE									TOTAL
	WESTERN			EASTERN			NORTHERN			
	a	b	c	a	b	c	a	b	c	a
1977	2	28.6		4	57.1		1	14.3		7
1978	19	22.9		28	33.7		36	43.4		83
1979	32	21.6	32.9%	64	43.2	19.5%	52	35.1	47.6%	148
1980	30	21.9		60	43.8		47	34.3		137
1981	21	19.1		54	49.1		35	31.8		110

* a, b, and c as in previous tables

Table 3.07: Distribution of new coffee adopters/dropouts per zone per year.

YEAR	ZONE										TOTAL
	WESTERN			EASTERN			NORTHERN				
	a*	b*	c*	a	b	c	a	b	c		a
1974	12	22.2		8	14.8		34	63.0			54
1975	15	28.3		9	17.0		29	54.7			53
1976	3	7.1		8	19.0		31	73.8			42
1977	0	0		0	0		0	0			42
1978	+2	11.8		4	23.5		11	64.7			17
1979	-2	-18.2	32.9	-1	-9.1	19.5	-8	-72.7	47.6		-11
1980	-7	-20.0		-9	-25.7		-19	-54.3			-35
1981	0	0		0	0		-2	100			-2

* a, b and c as in previous tables

Table 3.08: Distribution of new wheat adopters/dropouts per zone per year

YEAR	WESTERN			EASTERN			NORTERN			TOTAL
	a *	b *	c *	a	b	c	a	b	c	a
1977	2	28.6		4	57.1		1	14.3		7
1978	17	22.3		24	31.6		35	46.1		76
1979	13	20.0	32.9	36	55.4	19.5	16	24.6	47.6	65
1980	-1	-9.1		-5	-45.5		-5	-45.5		11
1981	-6	-22.2		-9	-33.3		-12	-44.4		27

* a, b and c as in previous tables

When considering the adoption of coffee and wheat in the three zones, it is important to see whether each zone has more or less than its "fair" share of adopters as based on its share of the total number of households (Table 3.05 and 3.06). The Western zone's fair share is 32 per cent, while the respective figures for the Eastern and Northern zones are 20 and 48 per cent.

a. Coffee

Considering coffee adoption, the Western zone had less than its fair share throughout the study period 1974 to 1981. The proportion of the whole area's adopters found in this zone was only 22 per cent in 1974. This rose to 25 per cent in 1975 but dropped to 20 per cent in 1976. Thereafter, the share was constant at 19 per cent from 1978 through to 1980 with a slight increase to 20 per cent in 1981.

In the Eastern zone, the "fair" share percentage is 20 per cent. During some years, an almost "fair" share of adopters was reached. In 1976, 15 per cent of all adopters were found in this zone. This increased to 16 per cent in 1975 to 17 per cent in 1976 and to 18 per cent in 1978. However, this figure dropped to about 16 per cent in 1980 and 1981.

The Northern zone's case is interesting because the percentage of adopters exceeds the "fair" share percentage of about 48 per cent throughout the study period 1974 to 1981. In 1974, this zone had 63 per cent of the adopters. This dropped to 59 per cent in 1975, rose back to 63 per cent in 1976 where it remained through to 1979. There was an increase to 65 per cent in 1980 and 1981.

It is seen that in the Western Zone, the percentage of adopters falls short of the expected fair share while in the Eastern zone, the percentage of adopters comes quite close to the expected fair share of adopters. The Northern zone on the other hand has its percentage of adopters greatly exceeding the expected fair share of adopters. The reasons for these anomalies could be explained in terms of the differences in accessibility, population distribution and to some minor extent the environmental differences among the three zones. The Northern zone is the most accessible of the three zones. Because of this advantage , the percentage of adopters clearly exceeds the expected "fair" share of adopters. This is because the movement of both people and goods within this zone and from Old Fife is easy and fast. The Eastern zone whose percentage of adopters is close to the percentage of "fair" share of adopters is the second most accessible zone. This, therefore, means that the good accessibility rate has made its percentage of adopters almost equal to the expected fair share percentage of adopters. On the other hand, the Western zone does not fare well because its percentage of adopters in relation to the expected "fair" share is very low. This is mainly because of the accessibility of this area which means the large population may not be reached at all by extension workers

and hence they do not adopt.

b. Wheat

When considering the percentage of adopters in relation to the expected "fair" share percentage of adopters for wheat among the three zones, it can be seen that in the Western zone, the fair share percentage of adopters is taken to be about 33 per cent. During the first years of 1977, the percentage of adopters was 29 and hence could be said to have been fair given the "fair" share percentage of adopters in this zone. In 1978 the percentage of adopters dropped to about 23 through to 22 per cent in 1979 and 1980 on to 19 per cent in 1981. In the Eastern zone, the data is interesting in that the expected "fair" share percentage of 20 is well below the percentage of adopters reached from 1977 to 1981 by as much as 30 per cent in some cases. Hence the percentage of adopters in 1977 was 57 which dropped to 34 per cent in 1978 through to 43 per cent in 1979. There was a slight rise to 44 per cent in 1980 through to 49 per cent in 1981. The Northern zone fares fairly well in that the margin between the percentage of adopters and the expected fair share percentage of adopters is not quite big. The expected fair share percentage of adopters is 48 while the percentage of adopters rose from 14 in 1977 to 43 per cent in 1978 but dropped to 35 per cent in 1979 through to 32 per cent in 1981.

Amongst the three zones, the Western zone fares better than the rest in as far as wheat adoption is concerned. The Eastern zone's percentage of adoption goes very much higher than the expected fair share percentage of adopters basically because of the fact that this zone is the second most accessible but has the least population and with the IRDP efforts to encourage wheat growing spread over a relatively small population, the results were found to be very good. The Northern zone appears to have a fair share of adopters.

c. Comparison of zones in coffee and wheat adoption. If an attempt is made to compare how the three zones fare in their rates of new adopters for the two crops under study, it is found out that except for the Western zone, the Eastern and Northern zones do not decline so much in their rates of new adopters for both coffee and wheat. As far as coffee is concerned, the Northern zone shows a higher rate of new adopters (and even dropouts) per year than any other zone. This is followed by the Eastern zone although the difference between the Eastern and Western zones is, however, not as striking as that of either Eastern or Western compared to the Northern zone. As for wheat, the zone with the highest percentage of new adopters is the Northern followed by the Eastern. The Western zone, therefore, has the lowest percentage of new adopters for both coffee

and wheat. These results conform to the realities which exist in the three zones. The Northern zone is the most accessible and has the largest population followed by the Eastern zone and lastly the Western. This, therefore, means that the IRDP personnel were finding it relatively easy to deliver their extension advice to those in the Northern zone followed by those in the Eastern zone, hence most new adopters were from the Northern followed by the Eastern zones and lastly the Western zone.

Table 3.09: Cumulative number of coffee adopters and new adopters as a percentage of the farming population per year by zone

YEAR	CUMULATIVE NUMBER OF ADOPTERS AS A PER CENTAGE OF TOTAL FARMING POPULATION PER YEAR BY ZONE				NUMBER OF NEW ADOPTERS AS A PER CENTAGE OF TOTAL ARMING POPULATION PER YEAR BY ZONE			
	WESTERN	EASTERN	NORTHERN	TOTAL	WESTERN	EASTERN	NORTHERN	TOTAL
1974	3.8	4.3	7.5	5.7	3.8	4.3	7.5	5.7
1975	8.6	9.1	15.9	11.2	4.8	4.8	6.4	5.5
1976	9.6	13.4	20.7	15.6	1.0	4.3	4.8	4.4
1977	9.6	13.4	20.7	15.6	0	0	0	0
1978	10.2	15.6	23.1	17.4	0.6	2.2	2.4	1.8
1979	9.6	15.1	21.3	21.2	0.6	0.5	1.8	1.2
1980	7.3	10.2	17.1	12.6	3.8	2.9	4.2	3.7
1981	7.3	4.2	16.7	19.7	0	0	0.4	0.2

Table 3.10: Cumulative number of wheat adopters and new adopters as a percentage of farming population per year by zone

	CUMULATIVE NUMBER OF ADOPTERS AS A PERCENTAGE OF TOTAL FARMING POPULATION PER YEAR BY ZONE				NUMBER OF NEW ADOPTERS AS A PERCENTAGE OF TOTAL FARMING POPULATION PER YEAR BY ZONE			
	WESTERN	EASTERN	NORTHERN	TOTAL	WESTERN	EASTERN	NORTHERN	TOTAL
1977	0.6	2.2	0.2	0.7	0.6	2.2	0.2	0.7
1978	6.1	15.1	7.9	8.7	5.4	12.9	7.7	8.0
1979	10.2	34.4	11.4	15.5	4.1	19.4	3.5	6.8
1980	9.6	32.3	10.3	14.3	0.3	2.7	1.1	1.2
1981	6.7	29.0	7.7	11.5	1.9	4.8	2.6	2.8

Further analysis involves a comparison of the zones to try and identify which zone got a higher percentage of their farming population as adopters or new adopters per year (Table 3.09 and 3.10). Here it is seen again that in terms of coffee, the Northern zone has the highest percentage of both the cumulative number of adopters as a percentage of the farming population which started with about 8 per cent in 1974 increased to a peak of 23 per cent in 1978 but decreased to about 17 per cent in 1981 for the cumulative number of adopters. The next zone with a high number of cumulative number of adopters in relation to the total farming population is the Eastern and lastly is the Western zone. This is very much in line with the other findings on how the three zones fare in coffee adoption.

As for wheat, (Table 3.10) the zone that fares well in as far as the cumulative number of adopters in relation to the total farming population is the Eastern zone followed by the Northern zone. The Western zone, therefore, lags behind even here because of poor accessibility and a low population distribution

3.06 SOCIO-ECONOMIC VARIATIONS AMONG ADOPTERS AND NON ADOPTERS

When discussing the adoption of any phenomenon in space over time, there is need to know the characteristics of all the people and their concentration in space. This is so because it has been found that access to information and resources does not only depend on location in space (Yapa, 1977, Blaikie, 1978 and Browett, 1980). Adoption is complex in the sense that the access to both information and to the resources which make innovation viable are not only controlled by location, but also by the class structure and political organisation of a society. Class, therefore, can influence who adopts and who does not, because it affects who gets what type of information and where and who has the resources to respond to an innovation. A concentration of adoption may, therefore, be due to a concentration of certain characteristics which encourage the adoption of a given phenomenon.

In this section, five characteristics of farmers which are variables which may affect adoption will be discussed. These variables are educational level attained, migration history, the type of work in which the farmer was engaged as a migrant, household size and cash crop production.[2] This section attempts to find out whether

these variables appear to have had any influence on people accepting the agricultural innovations of coffee and wheat growing.

3.06.1 Educational level attained

Higher levels of education may help someone comprehend an innovation and its value to them. It also usually raises people's social status and so may affect their social contacts which may improve their access to information. Education may change people's attitudes and values especially by reducing traditional values and making people more prepared to adopt new ideas. It is, therefore, assumed that education can encourage someone to adopt an agricultural innovation (Yapa, 1977, Blaikie, 1978 and Cox and Colledge, 1981).

Table 3.11: Educational level attained

LEVEL OF EDUCATION	ADOPTERS		NON-ADOPTERS	
	NO.	%	NO.	%
NO FORMAL EDUCATION	12	29.27	18	30.0
PRIMARY EDUCATION	26	63.41	40	66.67
SECONDARY EDUCATION	3	7.32	2	3.33
TOTAL	41	100	60	100

Considering the table above, few differences in the standard of education between adopters and non-adopters can be noted. Among the adopters, about 71 per cent have at least attained some formal education which is similar to the non-adopters of whom 70 per cent have also attained formal education. Some slightly greater differences are noted when the level of education attained is analysed. Among the adopters, about 63 per cent had only reached the primary school level and 7 per cent secondary school level. This compares with about 67 per cent and 3 per cent among the non-adopters respectively. Among the non-adopters, however, the highest percentage only went as far as lower primary level and none went further than junior secondary level.

Further investigation involved a comparison of adopters and non-adopters using the Chi-square test to see whether there is any significant relationship between educational level attained and the adoption or non-adoption of an agricultural innovation (Table 3.11b). The Chi-square analysis does not yield any significant relationship. It can, therefore, be concluded that in this case there is no significant relationship between the level of education of a farmer and his choice of whether to adopt or not. The explanations to this unexpected finding will be given in the discussion at the end of this chapter.

Table 3.11b

	NO EDUCATION	PRIMARY EDUCATION	SECONDARY EDUCATION	TOTAL
ADOPTERS	12	26	3	41
NON-ADOPTERS	16	40	2	58
TOTAL	28	66	5	99*

$X^2_{obs.} = 0.85$[a]

df = 2

X^2_{crit} (0.05) = 5.991

∴ Accept the null hypothesis that there is no significant relationship between educational level attained and the adoption or non adoption of an agricultural innovation.

*This figure does not add up to 101 because among the non-adopters, two respondents did not give their educational level.

a. Calculations for all tests used can be found in appendix A.

3.06.2 Migration history

Migration experience is an asset that often helps migrants progress economically and socially once they return home. Travel experience is basic in changing their attitudes towards things and by introducing migrants to new experiences it can reduce resistance to innovation.

Table 3.12 a) Migration history

	NEVER MIGRATED		MIGRATED TO ANOTHER DISTRICT		MIGRATED TO TOWN		MIGRATED OUTSIDE ZAMBIA		TOTAL
	NO.	%	NO.	%	NO	%	NO.	%	
ADOPTERS	18	43.9	6	14.6	13	31.7	4	9.8	41
NON-ADOPTERS	36	60.0	88	13.3	12	20.0	4	6.7	60
TOTAL	54		14		25		8		101

An analysis of Table 3.12a above shows that about 56 per cent of the adopters had at one time or another left their home district for another district or town, or to go out side Zambia. In contrast only 40 per cent of the non-adopters had migrated outside their district.

The Chi-square analysis, however, reveals that there is no significant relationship between migration history and the adoption or non adoption of an agricultural innovation (table 3.12b).

Table 3.12b

	NEVER MIGRATED	MIGRATED TO ANOTHER DISTRICT	MIGRATED TO TOWN	MIGRATED OUTSIDE ZAMBIA	TOTAL
ADOPTERS	18	6	13	4	41
NON-ADOPTERS	36	8	12	4	60
TOTAL	54	14	25	8	101

$X^2obs = 2.84$

$df = 3$

$X^2crit\ (0.05) = 7.815$

∴ Accept the null hypothesis that there is no significant relationship between migration history and the adoption or non adoption of an agricultural innovation

3.06.3 Occupation while a migrant.

It is assumed that experience gained elsewhere as a migrant may have some influence on what a person does later once they return home. This is so because migrants earn various skills while away and they also have resources to bring back home which could be useful. Because of their occupations, they may also develop certain aspirations which they could fulfill once they return home.

Table 3.13a Occupation while a migrant

	AGRICULTURAL AND RURAL		GOVERNMENT SERVICE		INDUSTRY		UNSKILLED		TOTA
	NO.	%	NO.	%	NO.	%	NO.	%	
ADOPTERS	5	12.4	15	36.6	13	34.2	8	17.1	41
NON-ADOPTERS	6	10.0	9	15.0	27	43.3	18	31.7	60

Looking at Table 3.13a above, there does not appear to be any striking relationship between adopters and non-adopters in as far as occupation while a migrant is concerned. Twelve per cent of the adopters worked in agricultural and rural related jobs as compared to 10 per cent of the non-adopters who were employed in the same category. There were, however, 5 per cent of the non-adopters against no adopters who worked in the forestry department which in a way may help someone to adopt coffee as a cash crop.

Other job categories show various differences either in favour of adopters or non-adopters. Accordingly, there were 37 per cent of adopters in government service as opposed to only 15 per cent of the non-adopters. Thirty four per cent of the adopters against 43 per cent of the non-adopters were in industry and only 17 per cent adopters as compared to 32 per cent non-adopters were doing unskilled jobs.

Although it is said that experience is the best teacher, it is, however, difficult in this case to measure the influence of work experience on the adoption of an agricultural innovation. Maybe it is because experience may not have the same influence upon everyone and also because experience needs to be analysed not in isolation, but in association with other factors like information source, length of residence as a migrant, length of stay in a particular employment and other personal characteristics.

The Chi-square test shows that there is no significant relationship between the occupation someone was engaged in as a migrant and the adoption or non-adoption of an agricultural innovation. But even with this observation, the relationship is almost significant since there is only a difference of 0.8 between the observed (7.0) and the critical (7.8) Chi-square values.

Table 3.13b Occupation while a migrant.

	AGRICULTURE AND RURAL	GOVERNMENT SERVICE	INDUSTRY	UNSKILLED	TO
ADOPTERS	5	15	13	8	4
NON-ADOPTERS	6	9	27	18	6
TOTALS	11	24	40	26	10

Although it is said that experience is the best teacher, it is, however, difficult in this case to measure the influence of work experience on the adoption of an agricultural innovation. Maybe it is because experience may not have the same influence upon everyone and also because experience needs to be analysed not in isolation, but in association with other factors like information source, length of residence as a migrant, length of stay in a particular employment and other personal characteristics.

The Chi-square test shows that there is no significant relationship between the occupation someone was engaged in as a migrant and the adoption or non-adoption of an agricultural innovation. But even with this observation, the relationship is almost significant since there is only a difference of 0.8 between the observed (7.0) and the critical (7.8) Chi-square values.

Table 3.13b Occupation while a migrant.

	AGRICULTURE AND RURAL	GOVERNMENT SERVICE	INDUSTRY	UNSKILLED	TOTAL
ADOPTERS	5	15	13	8	41
NON-ADOPTERS	6	9	27	18	60
TOTALS	11	24	40	26	101

$X^2obs = 7.0$

$df = 3$

$X^2crit(0.05) = 7.815$

∴ Accept the null hypothesis that there is no significant relationship between occupation when a migrant and the adoption of an agricultural innovation.

3.06.4 Household size.

The size of any household in a way determines how much labour will be available to work on the land. Larger households usually have more secure food supply and can risk innovations. They also have more labour which is often important as agricultural innovations often increase labour needs. Those with large households very much depend on their own members of the family for labour and spend very little money hiring extra labour. They, therefore, can save some money and use it to get other necessary inputs (Marter and Honeybone, 1976)

Table 3.14a Household size

HOUSEHOLD SIZE	A D O P T E R S		N O N - A D O P T E R S	
	NO.	%	NO.	%
1 - 3	3	7.3	27	45.0
4 - 6	4	9.8	21	35.0
7 - 9	11	26.8	4	6.7
10+	23	56.1	8	13.3
TOTAL	41	100	60	100

Analysing Table 3.14a above, it is seen that about 7 per cent of the adopters have 3 or less members in their households as compared to 45 per cent of the non-adopters. There are about 10 per cent of adopters with between 4 and 6 members in their households as compared to 35 per cent of the non-adopters and about 27 per cent adopters with between 7 and 9 members in the households as opposed to only 7 per cent among the non-adopters. Only 13 per cent of the non-adopters have more than 10 members in their households as compared to 56 per cent of the adopters. There are, therefore, 80 per cent of non-adopters households with less than 7 members in contrast to 83 per cent of adopters households with 7 or more members, a very considerable difference. Adopters are favoured in that they have more members in their house-

holds which greatly helps them in the overriding constraint on agricultural production which is the shortage of labour (Marter and Honeybone, 1976).

A further analysis of household size between adopters and non-adopters involved finding out whether there is any significant relationship between household size and the adoption of an agricultural innovation using the Chi-square test (Table 3.12b). Here, it was found out that a significant relationship exists between household size and the adoption of an agricultural innovation.

Table 3.12b.

HOUSEHOLD SIZE	A D O P T E R S	N O N - A D O P T E R S
	OBSERVED NUMBER	OBSERVED NUMBER
1 - 3	3	27
4 - 6	4	21
7 - 9	11	4
10+	23	8
TOTAL	41	60

X^2obs = 39.12

df = 3

X^2crit (0.05) = 7.815

∴ Reject the null hypothesis that there is no relationship between the size of the household and the adoption of an agricultural innovation.

3.06.5 Crops grown by adopters and non-adopters

This section analyses whether or not there are any differences between adopters and non-adopters in the variety of crops grown and the purpose for growing them. Purpose here is taken to mean subsistence, cash sale or both uses. Some crops are grown purely on a subsistence level while others are purely grown for sale. Most crops are, however, grown for both home consumption and for sale.

As was mentioned in Chapter Two, there is a persistence of the traditional crops like fingermillet, sorghum, beans and cassava in Ikumbi. Maize, although not very much a traditional crop is grown by everyone in the area.

Table 3.15 Crops grown by adopters/non adopters

CROP		CASH		MIXED		SUBSISTENCE		TOTAL
		NO.	PERCENTAGE	NO.	PERCENTANGE	NO.	PERCENTAGE	
Maize	Adopters	2	4.88	38	92.68	1	2.44	41
	Non-adopters	0	0	45	77.59	13	22.41	58
Fingermillet	Adopters	0	0	4	13.33	26	86.67	30
	Non-adopters	0	0	1	2.08	47	97.92	48
Sorghum	Adopters	0	0	1	10.00	9	90.0	10
	Non-adopters	0	0	0	0	16	100.	16
Beans	Adopters	0	0	19	57.58	14	42.42	33
	Non-adopters	0	0	16	34.04	31	65.96	47
Cassava	Adopters	0	0	1	3.57	27	96.43	28
	Non-adopters	0	0	5	10.87	41	89.13	46

It can clearly be seen that sorghum, fingermillet and cassava are basically grown for subsistence purposes by both the adopters and non-adopters. Fingermillet, however, although usually referred to as a subsistence crop is a cash crop in its own right since it is mainly used for beer brewing which is basically for sale. Amongst the non-adopters, there is no single one who grows any crop for cash purposes only, whereas 5 per cent of the adopters grow maize for cash purposes only. Only 2 per cent grow maize for subsistence among the adopters as compared to 22 per cent among the non-adopters and on the overall, 100 per cent of adopters grow maize as compared to 97 per cent of the non-adopters.

Among the adopters of wheat and coffee, therefore, there is also a higher market orientation in their cereal growing. In all cases, except cassava, a higher percentage of adopters grew the crop with some sale considerations (i.e. the mixed category) than the non-adopters. Although it is not clear from this data if these crops for marketing were grown before adopting coffee or wheat, there probably is a relationship between market orientation in cereal and propensity to adopt other cash crops such as coffee and wheat. The ability to grow cereals for sale tends to show that subsistence needs are securely met and so

farmers can risk entering into the production of other crops for sale.

3.06.7 Discussion

All of the socio-economic variables under consideration were assumed to have a direct influence on the adoption of an agricultural innovation before the start of this study, but results from data collected in the field area have not proved this in most cases. The variables considered included educational level attained, migration history, work involved in by those who had migrated and household size which is the only one which conformed to the assumption that the larger the household the higher the likelihood of that household to adopt.

With respect to the other variables, this may not have conformed to the assumed norm because of four factors. The First is the IRDP's policy of visiting and extending their extension services to all households in the whole project area in order to overcome the traditional or normal bias of extension services staff towards the "better-off" and more educated farmers who in any case have dominated coffee growing here in the past. The IRDP, therefore, adopted a deliberate policy not to concentrate on certain people. This led to the finding in this study that educational level attained by both the adopters and the non-adopters was not significantly

different.

Secondly, the non-conformity of the available socio-economic data and their expected influence on the adoption of an agricultural innovation could have arisen from the sample choice of non-adopters. It maybe that despite the researcher's intention of representing all socio-economic groups equally, the poorest were not really given a fair share in the chosen sample (which involved interviewing every nth non-adopters household from a large list of non-adopters provided by the extension workers).

Thirdly, it could be because of indirect influence due to the social links and their effect on innovation. For example, a returned migrant may decide to help his brother who has no education or has never migrated and by this help he decides to adopt, but socio-economic data shows that this particular person without any education and who has never migrated has adopted an agricultural innovation, but this data hides the fact that he adopted because he got help and advice from an educated relation who had migrated.

The fourth reason for this non-conformity of socio-economic data to the expected influence on the adoption of an agricultural innovation could be due to some "big men" in society who have no formal education, no previous

work experience gained while away from their homes, but who adopt an agricultural innovation essentially because they have resources and have the right contacts for information which is conducive for adoption.

Footnotes.

1. The accessibility index was calculated by first calculating the total area for each zone and the total length of all roads (in kilometres) per zone and then dividing the former by the latter, hence:

$$\text{Accessibility} = \frac{\text{Area of zone}}{\text{Total length of roads of zone}}.$$

2. The size or hectarage under cultivation by both adopters and non-adopters could have been another important variable here, but it is extremely difficult to get this type of data because most cultivated fields of peasant farmers are usually scattered and fragmented in many places. They are not in one continuous whole as is the case with commercial farmers.

Other important variables could have been age and social status, but these too proved to be extremely difficult to get especially age in that most people did not know exactly when they were born or how old they were when they adopted a particular agricultural innovation.

CHAPTER FOUR

C O N C L U S I O N S

In an effort to try and develop the rural areas the government initiated the IDZ programme, later to become the IRDP. This followed its own strategies in order to improve the living standards of the rural people. Such a programme and the strategies and policies it follows should, therefore, be evaluated and analysed in terms of their success or failure in overcoming the problems for which a solution was sought through its implementation.

In the Ikumbi area, the IRDP was trying to raise the living standards of the people through agricultural development. It, therefore, helped farmers in the area in various ways including the distribution of inputs, dissemination of extension services, marketing of produce, construction of feeder roads, sinking of boreholes and in some cases even training of both men and women.

In this case, the ministry responsible for agriculture initiated a programme that was intended to reduce the poverty of the people in Ikumbi by way of concentrating their efforts in one locality which was chosen to be the innovation or growth centre. The innovation, which

were to contribute to the alleviation of poverty through improved agricultural techniques and especially cash cropping were expected to diffuse from here. On this basis, the diffusionist paradigm and the policies related to it developed by the IRDP can be said to be quite satisfactory in explaining the change which has been in this area.

Data shows that the IRDP, as a programme for rural development achieved some results in terms of increased production and participation in cash cropping. However, when the results compares with the Hagerstrand (1967) innovation diffusion theory, there is some satisfactory coincidence, but little coincidence with the critique of the diffusionist paradigm as suggested by Yapa (1977) and Blaikie (1978). It thus appears that the actual data fits some aspects of the original model well, but not so well with certain aspects of the critique. The situation is, therefore, much more complex in reality than this model, on which the scheme was based would suggest.

It was seen that the original model of innovation diffusion by Hagerstrand (1967) is useful in explaining the situation here. Distance decay explaining the neighbourhood effect was found to play some role in

explaining whether or not farmers adopt an agricultural innovation. Hence there was 26 per cent of adopters to total households in the 2 kilometre radius distance zone as against 13 per cent in the 10 kilometer radius distance zone for coffee and 45 and 7 per cent in the 2 kilometre radius and 10 kilometre radius for wheat respectively. It was found out that there is an inverse relationship between distance from the innovation centre and the rate of accepting an agricultural innovation Related to the notion of distance decay is the question of accessibility which was also found to be important in accepting an agricultural innovation.

There was also some conformity of the time period and the resultant S-shaped curve. The curves for both coffee and wheat do not, however, reach a 100 per cent adoption rate as is the case with the hypothetical one mainly due to the fact that adoption is a slow process and the project had been going for only a short time. Secondly, it is questionable if everyone could adopt, as not everyone may have resources, skills or even inclination. This may vary between coffee and wheat as the latter is more easily fitted in than the former and needs less long term investment for wheat which people often dislike.

When socio-economic variables were considered, it was found out that unlike in the critique of the original innovation diffusion model by Yapa (1977) and Blaikie (1978) which suggested that a lot of socio-economic variables like level of education, availability of resources and access to information were more important influences upon the adoption of an agricultural innovation than distance from the centre of innovation, in this study, it was difficult to see any clear and statistically significant influence of these variables. Several of the socio-economic variables studied were found not to have had a lot of influence upon adoption. These were educational level attained, migration experience and work experience as a migrant but household size was found to have a lot of influence upon adoption. This is so because of the importance of household size in deciding the availability of labour for all the farm work to any particular family. Maybe the above explanation for non importance of supposedly key variables may not be relevant and rather this household size is so strong in this situation as labour is a critical factor that it overcomes all other supposed influences upon adoption.

It seems that because of the IRDP policy in the area which was trying to remove the traditional bias, for example, the tendency among the extension staff to pay most attention to educated people in society, there was positive

discrimination against those farmers who seemed to be prominent or at least to ensure that all groups (by socio-economic characteristics) were included. The reasons for the non-conformity of these socio-economic variables to the agricultural innovation model are due to firstly the IRDP policy of visiting the target groups, secondly to unintended bias by the researcher where the poor in the area may not have been given a fair share in the sample and thirdly to the indirect influence of some relatives who had migrated and had some resources who helped their "poor" relations to adopt. The other reason could be attributed to some "big men" in society who have no formal education, no previous work experience gained while away from their homes, but who adopt essentially because they have the resources and have the right contacts for information necessary for adoption.

The spatial diffusion of innovations is a complex process requiring study of both the information source and its circulation together with access to resources and also the structural variables like the size of the farm, the distance of the farmer from the innovation centre and the ability to take risks. Hence favourable structural variables together with favourable personal characteristics of a farmer lead to a high adoption rate. It becomes difficult, however, to pinpoint with much accuracy and confidence what variables and factors are at play to let

one person adopt while the neighbour fails to do so, or to explain why one person adopts today, but it takes the neighbour several more years to adopt the same innovation. However, the available data shows that the variables with the most explanatory power is firstly the household size which shows the importance of labour in any agricultural work. Secondly is the accessibility of an area which is very much tied to the location of farmers in space. This also confirms the need for easy accessibility so that the farmers may get their inputs and sell their produce without too many problems.

So, one can suggest that in the Ikumbi IRDP area, the IRDP may have been good in trying to overcome some socio-economic characteristics of the population which tend to restrict innovations to some groups, but has not really been so successful as it is the economically powerful (those with large households) in most accessible places and nearest to the centre of innovation who have benefited. It can, therefore, be concluded that much care is needed in monitoring IRDPs to see how they operate and to ensure innovation is not restricted by economic characteristics or spatial location charateristics of farmers.

Appendix A

Ho: There is no significant relationship between the level of education attained and the adoption of an agricultural innovation.

Ha: There is a significant relationship between the level of education attained and the adoption of an agricultural innovation.

CATEGORY	NO EDUCATION	PRIMARY EDUCATION	SECONDARY EDUCATION	TOTAL
ADOPTERS	12	26	3	41
NON-ADOPTERS	16	40	2	58
TOTAL	28	66	5	99

Expected frequencies for adopters and non-adopters:

CATEGORY	NO EDUCATION	PRIMARY EDUCATION	SECONDARY EDUCATION	TOTAL
ADOPTERS	$\frac{41 \times 28}{99}$ = 11.60	$\frac{41 \times 66}{99}$ = 27.33	$\frac{41 \times 5}{99}$ = 2.07	41
NON-ADOPTERS	$\frac{58 \times 28}{99}$ = 16.40	$\frac{58 \times 66}{99}$ = 38.67	$\frac{58 \times 5}{99}$ = 2.93	58
TOTAL	28	66	5	99

$X^2 = \sum \frac{(O - E)^2}{E}$, where O is the observed and E the expected data.

$$= \frac{(12 - 11.60)^2}{11.60} + \frac{(26 - 27.33)^2}{27.33} + \frac{(3 - 2.07)^2}{2.07}$$

$$+ \frac{(40 - 38.67)^2}{38.67} + \frac{(2 - 2.93)^2}{2.93} + \frac{(16 - 16.40)^2}{16.40}$$

$$= 0.014 + 0.065 + 0418 + 0.01 + 0.046 + 0.295$$

$\therefore X^2 = 0.848$

df = (2 - 1) (3 - 1) = 1 x 2 = 2

At 0.05 $\Longrightarrow$ 5.991

At 0.01 $\Longrightarrow$ 9.210

$X^2 obs < 5.991$

$X^2 obs < 9.210$

$\therefore$ Accept the null hypothesis that there is no significant relationship between the level of education attained and the adoption of an agricultural innovation.

Ho: There is no significant relationship between the migration experience and the adoption of an agricultural innovation.

HA: There is a significant relationship between the migration experience and the adoption of an agricultural innovation.

CATEGORY	NEVER MIGRATED	MIGRATED TO ANOTHER DISTRICT	MIGRATED TO TOWN	MIGRATED OUTSIDE ZAMBIA	TOTAL
ADOPTERS	18	6	13	4	41
NON-ADOPTERS	36	8	12	4	60
TOTAL	54	14	25	8	101

Expected frequences for adopters and non-adopters:

CATEGORY	NEVER MIGRATED	MIGRATED TO ANOTHER DISTRICT	MIGRATED TO TOWN	MIGRATED OUTSIDE ZAMBIA	TOTAL
ADOPTERS	$\frac{41 \times 54}{101}$ = 21.92	$\frac{41 \times 14}{101}$ = 5.68	$\frac{41 \times 25}{101}$ = 10.15	$\frac{41 \times 8}{101}$ = 3.25	41
NON-ADOPTERS	$\frac{60 \times 54}{101}$ = 32.08	$\frac{60 \times 14}{101}$ = 8.32	$\frac{60 \times 25}{101}$ = 14.85	$\frac{60 \times 8}{101}$ = 4.75	60

$X^2 = \sum \frac{(O - E)^2}{E}$, where O is the observed and E the expected data.

$$= \frac{(18 - 21.92)^2}{21.92} + \frac{(6 - 5.68)^2}{5.68} + \frac{(13 - 10.15)^2}{10.15} + \frac{(4 - 3.25)^2}{3.25}$$

$$+ \frac{(36 - 32.08)^2}{32.08} + \frac{(8 - 8.32)^2}{8.32} + \frac{(12 - 14.85)^2}{14.85} + \frac{(4 - 4.75)^2}{4.75}$$

$$= 0.701 + 0.018 + 0.800 + 0.173 + 0.480 + 0.012 + 0.547 + 0.118$$

$\therefore \quad X^2 = 2.85$

df = (2 - 1) (4 - 1) = 1 x 3 = 3

At 0.05 = 7.815

At 0.01 = 11.345

$X^2_{obs} < 7.815$

$X^2_{obs} < 11.345$

$\therefore$ Accept the null hypothesis that there is no significant relationship between migration experience and the adoption of an agricultural innovation.

Ho: There is no significant relationship between occupation when a migrant and the adoption of an agricultural innovation.

HA: There is a significant relationship between occupation when a migrant and the adoption of an agricultural innovation.

CATEGORY	AGRICULTURE AND RURAL	GOVERNM-SERVICE	INDUSTRY	UNSKI-LLED	TOTAL
ADOPTERS	5	15	13	8	41
NON-ADOPTERS	6	9	27	18	60
TOTAL	11	24	40	26	101

Expected frequencies for adopters and non-adopters:

CATEGORY	AGRICULTURE	GOVERNM-ENT SERVICE	INDUSTRY	UNSKI-LLED	TOTAL
ADOPTERS	$\frac{41 \times 11}{101} = 4.47$	$\frac{41 \times 24}{101} = 9.74$	$\frac{41 \times 40}{101} = 16.24$	$\frac{41 \times 26}{101} = 10.55$	41
NON-ADOPTERS	$\frac{60 \times 11}{101} = 6.53$	$\frac{60 \times 24}{101} = 14.26$	$\frac{60 \times 40}{101} = 23.76$	$\frac{60 \times 26}{101} = 15.45$	60
TOTAL	11	24	40	26	101

$X^2 = \sum \frac{(O - E)^2}{E}$, W where O is the observed and E the expected data.

$$= \frac{(5 - 4.47)^2}{4.47} + \frac{(15 - 9.74)^2}{9.74} + \frac{(13 - 16.24)^2}{16.24}$$

$$+ \frac{(8 - 10.55)^2}{10.55} + \frac{(6 - 6.53)^2}{6.53} + \frac{(9 - 14.26)^2}{14.26}$$

$$+ \frac{(27 - 23.76)^2}{23.76} + \frac{(18 - 15.45)^2}{15.45}$$

$$= 0.063 + 2.841 + 0.646 + 0.616 + 0.043 + 1.940$$

$$+ 0.442 + 0421$$

$\therefore X^2 = 7.012$

df = (2 - 1) (4 - 2) = 1 x 3 = 3

At 0.05 $\Longrightarrow$ 7.8

At 0.01 $\Longrightarrow$ 11.3

$X^2_{obs} < 7.8$

$X^2_{obs} < 11.3$

$\therefore$ Accept the null hypothesis that there is no significant relationship between occupation while a migrant and the adoption of an agricultural innovation.

Ho: There is no significant relationship between the size of a household and the adoption of an agricultural innovation.

HA: There is a significant relationship between the size of a household and the adoption of an agricultural innovation.

HOUSEHOLD SIZE	ADOPTERS	NON-ADOPTERS	TOTAL
1 - 3	3	27	30
4 - 6	4	21	25
7 - 9	11	4	15
10+	23	8	31
TOTAL	41	60	101

Expected frequencies for adopters and non-adopters:

HOUSEHOLD SIZE	ADOPTERS	NON-ADOPTERS	TOTAL
1 - 3	$\frac{41 \times 30}{101}$ =12.18	$\frac{60 \times 30}{101}$ =17.82	30
4 - 6	$\frac{41 \times 25}{101}$ =10.15	$\frac{60 \times 25}{101}$ =14.85	25
7 - 9	$\frac{41 \times 15}{101}$ = 6.09	$\frac{60 \times 15}{101}$ = 8.91	15
10+	$\frac{41 \times 31}{101}$ =12.58	$\frac{60 \times 31}{101}$ =18.42	31
TOTAL	41	60	101

$X^2 = \sum \frac{(O - E)^2}{E}$, where O is the observed and E the expected data.

$$= \frac{(3 - 12.18)^2}{12.18} + \frac{(27 - 17.82)^2}{17.82} + \frac{(4 - 10.15)^2}{10.15}$$

$$+ \frac{(21 - 14.85)^2}{14.85} + \frac{(11 - 6.09)^2}{6.09} + \frac{(4 - 8.91)^2}{8.91}$$

$$+ \frac{(23 - 12.58)^2}{12.58} + \frac{(8 - 18.42)^2}{18.42}$$

$= 6.92 + 4.73 + 3.73 + 2.55 + 3.96 + 2.71 + 8.63 + 5.89$

$\therefore X^2 = 39.12$

$df = (4 - 1)(2 - 1) = 3 \times 1 = 3$

At $0.05 \Longrightarrow 7.815$

At $0.01 \Longrightarrow 11.345$

$X^2_{obs} > 7.815$

$X^2_{obs} > 11.345$

$\therefore$ Reject the null hypothesis that there is no relationship between the size of the household and the adoption of an agricultural innovation.

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