IMPACT OF RURAL FEEDER ROADS ON RURAL DEVELOPMENT

A CASE STUDY OF KILOSA DISTRICT

By

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DECLARATION

I, HENRY RWAMASASA MUNYANGANIZI do hereby declare to the Senate of the University of Dar-es-Salaam that the work presented in this thesis is my own and has not been submitted for a degree award in any other University.

Date:..16/7/83....

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ABSTRACT

Kilosa District rural roads programme is part of the rural development programmes being undertaken by the Irish Development Agency in the District. The agency has undertaken to improve two rural roads by building bridges and culverts and grading the roads to all weather conditions.

The two roads, Myombo-Kidete and Rudewa-Nongwe are to serve the Communication Stricken mountain areas of Rubeho and Nongwe, in order to enable the people in that part of Kilosa District to raise their standards of living, by improving agriculture, marketing produce and gaining access to socio-economic infrastructures. The people of the area at the moment face severe lack of rural roads and rural transport to link them to sources of farm inputs, markets for agricultural produce sources of contacts for extension agents, health services, communication systems and other necessary social infrastructures.

The study was designed to analyse factors which affect the development of rural areas in Kilosa District namely:

1. The difficulties faced by farmers in obtaining farm inputs, sources of farming knowledge and

social infrastructures.

2. Examine socio-economic situation and conditions of living and suggest ways of improving them.

3. To evaluate impact of rural roads programme on agricultural production, increase accessibility to social-economic infrastructures which will help in uplifting rural conditions of living of the people of the area.

In order to arrive at meaningful conclusion/ recommendations, a review of rural roads programme in Tanzania beginning from early days of colonization was made. A historical account of the development of transport communications, roads and railways with specific emphasis on roads was taken. Ways and appropriate techniques of appraising roads in relation to Tanzanian economy were examined. The techniques applied in the study are Benefit Cost B/C ratio and Internal rate of return (IRR) which were based on the results obtained from estimates on road-user's benefits (operating cost savings) and induced agricultural benefits.

The study reviewed population structure, farming systems, communication and transport systems and marketing facilities in the area. It turned out to be that there is an apparent lack of rural roads and rural transport, markets for farm inputs and agricultural products, accessibility to health services, extension agency, severe lack of employment opportunities coupled with low incomes and low standards of living, and low prices for farm produce.

Based on the findings it was recommended that Kilosa District Rural Development Programme should go ahead to improve the two roads to all weather conditions. Following the improvement of the roads extension services should be stepped up both in number mobility and skill. Adequate inputs both for livestock and crops be introduced to farmers as soon as possible in time and frequency. Storage facilities at village level or central locations to be built, and should be done as soon as co-operative societies are reviewed. Prices for most agricultural produce are to be raised to step up farmers' morale, reduce cost of production and raise incomes. It was found necessary to build health centres for both people and livestock in the area. Also post primary institutions (secondary schools and vocational centres) should be built to open up employment opportunities.

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INTRODUCTION

1.1 Statement of the problem

The importance of rural roads in rural development in the world today cannot be overemphasized. Over 3/4 or 75 per cent of the world is agricultural population (F.A.O., 1981). More than half of the world population about 75 per cent of the less developed countries[1], live in the rural areas sustained chiefly by work on land and mutual services.

They produce not only food for themselves but also food and raw materials for the developed countries and their output is vital to the world economy (Hunter, 1978).

Rural people lack roads and rural transport to link them with the social and economic infrastructures. Of the total population in Tanzania estimated in 1973 and 1978 at 14.3 million and 18 million respectively, a little over 90% of the population are either directly and indirectly depending on agriculture for their living (Shayo *et al.*, 1982) Agriculture accounts for over 70 per cent of the country's total exports and over 40 per cent of the G.N.P. The country suffers from lack of rural roads and rural

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[1] Asia and Pacific account for 70-85%, Africa 80-90% and Latin America 40-50% respectively.

transport to link the rural areas with urban areas. There is also an apparent lack of improved technology and industrialization. The greatest part of the country suffers from inadequate or unreliable water supply. Most parts of the country are tsetse fly infested and inhabited. Majority of these tsetse infested areas cannot prevent regeneration. Lack of sufficient population discourages investment in marketing and transport facilities. Sheer lack of population in most areas retards development (Odero-Ogwel and Mlambiti, 1975).

There is enough food to feed the world population (F.A.O., 1981). The problem is only of lack of accessibility and mobility to organize distribution and redistribution of existing productive assets and of those that can be brought into existence. The problem is more acute in the developing countries which are in urgent need of food and agriculture. If rural small farmers and landless labourers are to contribute substantially to increased agricultural production to meet their own needs and those of the coming generations, they must have greater access to suitable land and water with which to grow their crops. They must gain access to all other inputs without which the crops will not grow or yield sufficiently to the services without which they cannot obtain these inputs, and to a distribution system that will give them a fair return on their own labour and at the same time ensure that food reaches those who need it most. In practice this means that they must have access to institutions capable of delivering these inputs and services (FAO, 1981). Rural roads and rural development are necessary in helping to organise land improvement; deliver inputs, teach new methods, provide rural credit and marketing facilities and back up all these facilities with research and training so as to permit new ideas to penetrate into the villages. Unless the distances that separate the rural from the urban industrial economy are bridged, the efforts to increase farm outputs and to raise rural living standards cannot succeed (Owen, 1965).

For agriculture to advance, the use of commercial fertilizer, insecticides and improved seed are probably the factors most responsible (FAO, 1963). In areas where transportation is inadequate and rural areas are inaccessible, supply problems have severely limited agricultural production. To reach remote areas distribution channels need to be diversified. Improved rural roads and rural transport are indeed the first essentials in the distribution of inputs, as well as for marketing of agricultural output. Local labour can be employed to build and maintain simple but effective feeder roads to link up small villages, thus providing employment which can sometimes be programmed for periods when work in the field is less demanding (FAO, 1981). Needless to say therefore, that effective use of improved farming techniques requires not only that they be moved, but that they reach the farmers at the right time and in the right amount. Lack of facilities precludes the general use of such inputs as well as the adoption of other technical innovations (Jones, 1965). In areas which have poor communication facilities as a result of lack of rural roads and other rural development infrastructures, farmers suffer great losses of food. Agricultural products which contain high protein are generally quite perishable especially in heat and humidity and a large proportion of the World's food grain is lost because storage is either unavailable or inadequate (FAO, 1964). For the developing countries to achieve a meaningful rural development which is defined as follows, " a mean of improving living standards of the masses of less income population residing in the rural areas and making the process of development selfsustaining" (Uma Lele, 1975; Pratt, 1969; Oman, 1976; Ominde _et al_. 1971; Mbilinyi, 1968; Maeda, 1976; Hunter, 1978 and Gilg, 1980), the following need to be done:

1. A package of inputs need to be improved, made available in sufficient quantities and transported within the reach of the farmers.

2. Food products marketed need to be transported, thus an ambitious expansion in transport and communication facilities is required in warehouses and in markets from the villages to the large urban/agglomeration. Transport should link rural areas of production to storage and marketing facilities.

3. Processing industries should be located increasingly in the rural areas or rural towns, where they will provide additional source of jobs and income. These processing industries can be used to modernize small farmers' methods of production and improve their income distribution.

4. Prices of agricultural produce, especially food in relation to the prices of inputs and consumer goods should be used as a basis of distributing incomes between the urban and the rural populations, and Finally to step up food consumption in the developing countries, the poor must have assets with which to produce enough food for themselves or jobs providing incomes with which they can buy the food for the growing number of rural people who do not have enough land to produce the food, or incomes they need, wage employment will have to fill the gap.

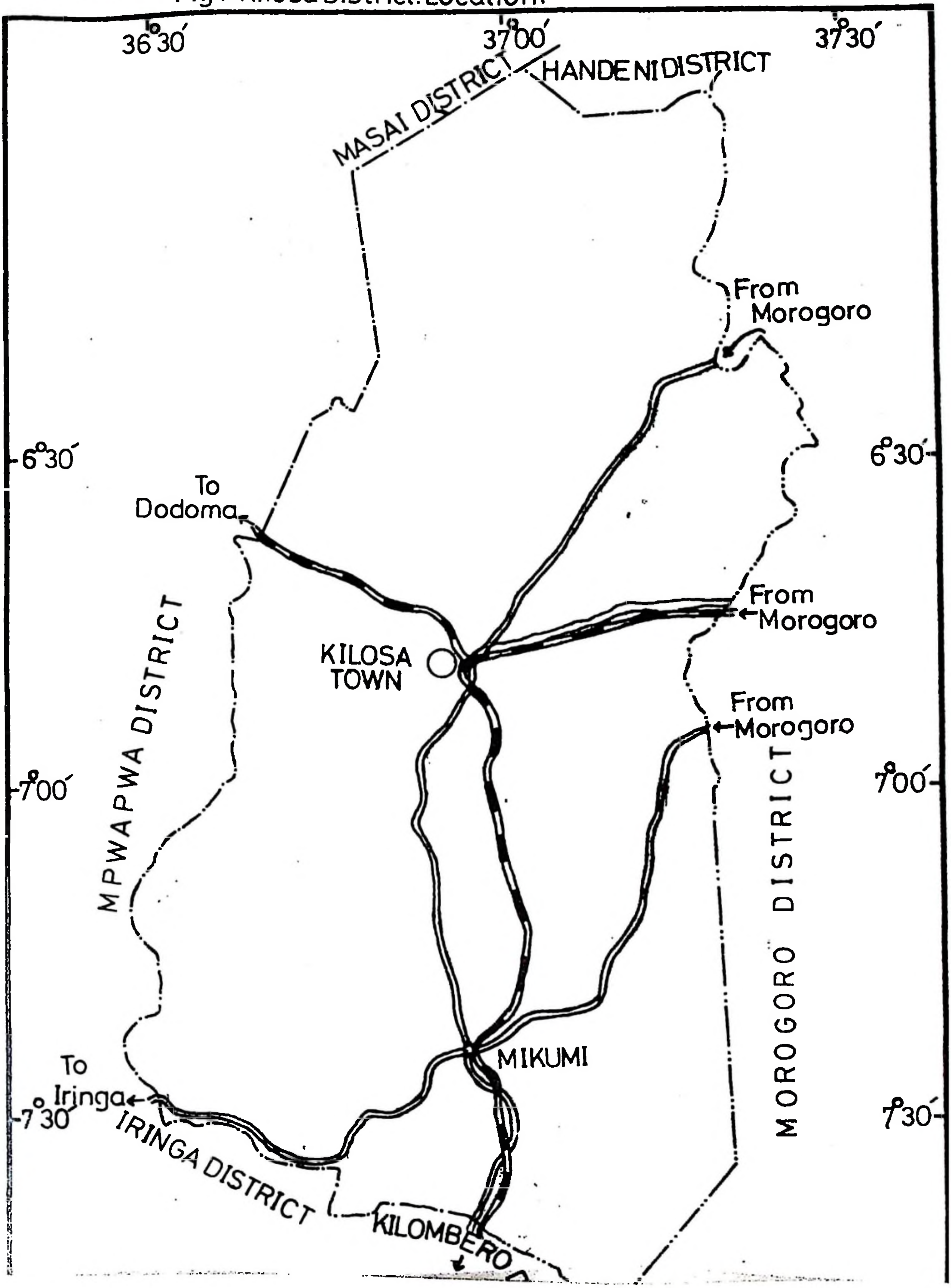
1.2 Justification of the study

The study area offers a good representation of rur... underdevelopment where there are no social and economic infrastructures and services due to lack of feeder roads and rural transport. The people of the area still travel several kilometres on foot to the markets or input supply centres with loads on their heads. They live several tens of kilometres away from the essential services and their standard of living is very low due to low per capita income, low consumption and unemployment, despite the presence of a substantial amount of human and natural resources for potential development.

These factors prompted a study on impact of feeder roads on rural development to be conducted in the Ukaguru and Rubeho mountain areas of Kilosa District, Morogoro Region, Tanzania. Kilosa District lies approximately between the parallels 6° 00' and 7° 30' South, and between the longitudes 36° 30' and 37° 30' East (See Fig. 1). The district boundary on the east is formed by Morogoro District, to the west by Mpwapwa District, to the north by Masai and Handeni Districts, and to the south-west and the south by Iringa and Kilombero Districts.

Kilosa District covers an area of approximately 14,245 Km^2 and has a population of about 274,378 out of a total population of 939,190 for Morogoro Region (1978 Census)

Fig 1: Kilosa District: Location.



The population density is approximately 19.3 persons per Km^2. The District has an annual rainfall lying between 800 and 1000 mm (Atlas of Tanzania, 1967). Usually the rains begin in December and continue until April with some light sporadic rains until May. The soil types are dark redish brown to red sandy loams with sandy clays in the valleys (BRALUP, 1971).

1.3 Modes of travel in Kilosa District

In any economy and social system the mode and the use of transport facilities is mainly determined by the economic status of the individual family, income and occupation of the society in general, the distance to be travelled, availability of different types of transport facilities, physical features of the land and the type and intensity of land use and the government transport policy. Several or a combination of all these factors determine the mode of travel depending on the availability, affordability and the government policy regarding the mode of travel suitable for the country's economy.

In Kilosa District the modes of travel are limited to only rail, road and foot, and these seem to have been determined largely by the terrain and non-availability of different types of transport.

(a) Rail: The Central Railway Line from Dar-es-Salaam to Kigoma passes through Kilosa District for a few kilometres, and covers only 42 Km. length between Kilosa and Kidete Stations within the study area. The Southern Line branches off the Central Line at Kilosa town on the Upper Mkondoa River, through the Mkata plains to Mikumi, Kidodi and on to Mkamba on Ruaha river. The two railway lines serve the villages along the railway stations and the sisal estates around Kilosa and Kimamba urban centres and those along Mkata plains. The railway lines pass through less populated areas since they are the low lands dry and with low rainfall, except along the alluvial soils of rivers Mkondoa and Mkata. Elsewhere in the district the railway services are unavailable.

(b) Road: By far, the roads are the most important means of travel in the district. There is a total length of 1,552 Km of roads of which 208 Km are trunk highways, 275 Km of lateral main roads and 1069 Km of feeder and track roads most of which are useable during the dry seasons plus numerous foot paths. Most of the roads are concentrated around Kilosa and Kimamba urban centres, running parallel to the railway line. These roads lead to the sisal estates along the plains of Mkata and Upper Mkondoa rivers, and all lead out of Kilosa and Kimamba to Morogoro, Gairo and Mikumi urban centres. The Ukaguru and Rubeho Mountain areas are without roads. In these highlands the only mode of travel is on foot and in very rare cases bicycles. Other areas with roads are the northern bordering Handeni and Masai Districts, but most of these roads are feeder and track roads usually unmaintained.

1.4 Study design

The terms of reference of the study were to assess the impact of rural feeder roads on rural development. The study was designed to cover three areas in Kilosa District. These are Myombo-Kidete, Rudewa-Nongwe feeder roads and the Central Railway. The villages along the two feeder roads are 9 and 4 villages along the Central Railway all totalling to 13.

(1) Myombo-Kidete feeder road 88 Km

The villages along this road are Dodoma, Chabima, Ibingu and Lumuma, which are accessible during the dry season and with 4 wheel-drive vehicles.

(2) Rudewa-Nongwe feeder road 136 Km

The villages along this road are Unone, Mtega, Nongwe, Mkobwe and Masenge. The road once existed in the 60's and was accessible throughout the year, but it has been neglected and no longer accessible except for a few kilometers from Gairo.

(3) The Central Railway

The villages along the Central Railway are Munisagara, Mzaganza, Mwasa and Kidete. With exception of Mwasa village the rest are railway stations. These villages are accessible throughout the year. The purpose of selecting these villages along the two feeder roads and along the Central Railway was to assess the level of development since villages along the two feeder roads are partly accessible during some period of the year while those along the Central Railway are accessible throughout the year. It was expected that the difference in transport system would result in different levels of development.

The two feeder roads, Myombo-Kidete and Rudewa-Nongwe are to be improved to all weather standards to make them accessible all year round. Already work has been started on Myombo-Kidete feeder roads by the Irish Republic Agency which is undertaking to construct Kilosa District Rural Development Projects. The Agency has started different projects in the District of which rural roads project is a major one. The Agency provides funds for constructing bridges and culverts, drainage and expanding of the roads, while the District authorities are to provide maintenance once the roads are improved.

Work is expected to start on Rudewa-Nongwe road once the road survey has been carried out and work on Myombo-Kidete is complete.

1.5 Location of the study area

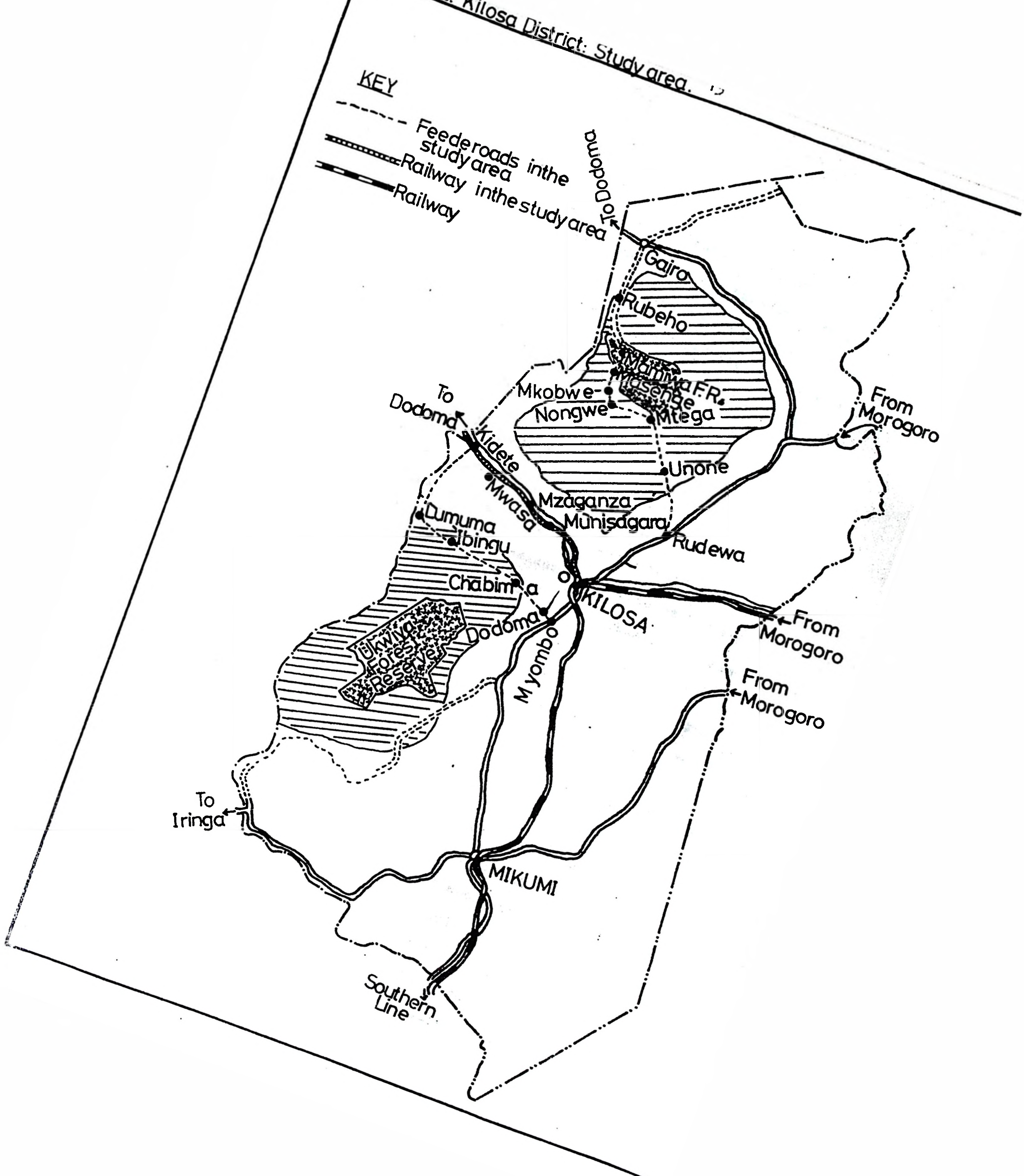
The two feeder roads Myombo-Kidete and Rudewa-Nongwe rise through the two adjacent mountain ranges of Rubuho and the Ukaguru, which are separated by Mkondoa river valley along which the Central Railway passes (See Fig. 2).

Myombo-Kidete feeder road rises through the north-west escarpment of Rubeho mountains, which are to the south-west and west of Kilosa town. Rudewa-Nongwe feeder road rises through the Ukaguru mountain ranges which are to the north of Kilosa. The Central Railway is along Mkondoa river valley which lies between the two mountain ranges. The altitudes of the villages along the two feeder roads and along the Central Railway vary with the course of the road or the railway and with the locational area which are described in the next section. The land terrain has significantly determined the level of the road development determining the general accessibility.

1.6 Description of study area

The two feeder roads, Myombo-Kidete and Rudewa-Nongwe pass through hilly areas which are tsetse infested. The land terrain and heavy rains in some parts of the area

Fig 2: Kilosa District: Study area.



pause severe problems in road construction and maintenance. The Central Railway which runs along the Mkondoa river, passes through a dry isolated valley sparcely populated. These problems have for long time hindered the development of the area. There are many other problems which will be shown in the subsections below which have retarded development in the area.

(i) Myombo-Kidete feeder road

Myombo-Kidete feeder road is the only road of the kind which serves the people of the Rubeho mountains. The road branches off Kilosa-mikumi main road at Myombo village 6 Km south-west of Kilosa town. This road rises north-west through the Rubeho mountains via a swampy area of about 4 Km. wide which floods during the rainy season becoming impassable. The swampy area lies between Myombo and Dodoma village which is 6 Km from Myombo. Dodoma village is at 600 m. above sea level. The village was settled in 1976 and has a population of 1,595 people.

The mean annual rainfall around Myombo and Dodoma villages is about 900 - 1100 mm., occurring between December and April with some light sporadic rains until May. The soils in the area are mainly dark brown to black loams and clay loams, with black cracking clays in the lower parts. In the forest area bordering Dodoma reddish brown sandy loams and sandy clays begin to appear.

The natural vegetation is a mixture of Acacia and Brachystegia woodland and wooded grassland especially in the forest area. Around Myombo and lower parts of Dodoma village, some sisal and sugar estates occupy a large proportion of land. The most important crops around Myombo and Dodoma villages are maize grown primarily for food but surplus sold, paddy, sorghum, beans, cassava, and bananas, while cotton and onions are grown mainly for cash. Animal husbandry is of minor importance, with a few goats, sheep and poultry kept. Land cultivation is concentrated near the villages, while large area of fertile land remain untouched.

From Dodoma the road rises gently through the foot hills of the northern Rubeho mountains and on to Chabima village 24 Km from Dodoma at an altitude of 1000 m. Chabima village was settled in 1970 and has a population of 513 people. The village is in an isolated forest area with plenty of uncultivated fertile land.

The mean annual rainfall ranges between 750 - 950 mm occurring between December and April with some light sporadic rains until May.

The soils are dark brown to black loams and clay loams in the lowlands, giving way to dark reddish brown loams and greyish brown loams on the hill slopes.

The natural vegetation varies from a mixture of Acacia and Brachystegia woodland and wooded grassland in the lower areas to Acacia-Commiphora bushland.

Main food crops grown are maize, grown primarily for food but surplus sold, sorghum, millet, beans, cassava and potatoes, with a few bananas. Cotton and some oil-seeds are grown but on very limited scale. Animal husbandry is of minor importance with a few goats, sheep and poultry kept for house consumption and little needy cash.

The main problem facing the people in the area, apart from inaccessibility and the presence of tsetse fly, are the wild animals (baboons, monkeys, pigs, elephants) and birds (queleaquelea) which destroy the crops. Also because of lack of health services and shortage of good water supply the people suffer from frequent malaria, and cholera attacks.

Beginning from Chabinia the road starts to rise sharply on to the north western escarpment of the Rubeho mountains (Ibingu hills) until Ibingu village 63 Km from Kilosa (27 Km from Chabima) at 1600 m. above sea level. Here the area is hilly and settlement is concentrated in the valleys and on the adjoining hill slopes. The village was settled in 1974 and has a population of 521. Ibingu village over looks Lumuma village and Lumuma river valley.

Lumuma village is 7 Km from Ibingu, 70 Km from Kilosa. It is along Lumuma river which forms the boundary of Kilosa and Mpwapwa Districts. Lumuma village was settled in 1967 and has a population of 1729 people. It is at a lower altitude than Ibingu village 1000 m. above sea level, compared to Ibingu at 1600 m. above sea level.

Both Ibingu and Lumuma villages are in a rain shadow zone receiving a mean annual rainfall of between 600-800 mm.

The soils are reddish brown loams in the valleys to shallow dark greyish brown loams on the hillslopes. There is very little land for cultivation. There is also considerable soil erosion due to steep slopes and low rainfall. No conservation measures are practiced. Cultivatable land around the villages is very scarce, farmers have to go far from their homes to look for suitable new land. And shifting cultivation is practiced.

The natural vegetation is Acacia-Commiphora bushland. The major crops grown are maize, grown for food surplus being sold, sorghum, millet, beans, cassava, potatoes and in few isolated cases bananas, sunflower and a little cotton. A good amount of onions and other vegetables and paddy are grown under furrow and hand irrigation practiced along the Lumuma river valley. However, there is little land available along the river for extensive cultivation. Some kind of intensive cultivation is practiced where a good amount of fertilizer is applied.

Animal husbandry is very minor with a few goats, sheep and poultry kept for household consumption and for fetching badly needed cash.

The farmers in the area are faced with the problem of scaring off wild animals and birds (queleaquelea) which destroy crops. It is a common practice for the farmers to erect huts around the shambas from the time crops are planted until harvest. This kind of work is strainous and reduces production as it occupies much of farmers valuable time.

From Lumuma, the road continues to Kidete station and on to Gairo. Kidete is 24 Km away from Lumuma. It is this part of the road that is accessible most parts of the year through Gairo. The rest of the road between Myombo and Lumuma is accessible during the dry season, the rest of the year it is impassable.

(ii) Rudewa-Nongwe feeder road

The Rudewa-Nongwe feeder road used to exist in the early 60's and was motorable all way to Gairo via the Ukaguru mountains. It used to connect Kilosa with the villages in this mountain area. The road has been neglected and is no longer accessible except a few villages which are accessible during dry seasons from Gairo. The road from Rudewa to Nongwe has become bushy and temporary bridges along it have been destroyed. It is expected that the road will be improved to all weather standards once funds are available.

The road branches off the Kilosa-Gairo road at Rudewa Gongoni 20 Km. north-east of Kilosa. From here the road rises from a lowland, gently to a highland at the foot of the Ukaguru mountains. Here the road reaches Unone village 47 Km from Kilosa at an altitude of 600 m. above sea level. The village was settled in 1970 and has a population of 1151 people.

The mean annual rainfall in the area ranges between 900 - 1100 mm. It occurs in the same rainy period for the whole of Kilosa District. The main soil types are reddish brown sandy loams and sandy clays dominating the area especially between Rudewa and Unone. The natural vegetation is Acacia and Brachgstegia woodland and wooded grassland. The main crops grown in the area are mainly maize, grown primarily for food but surplus sold, sorghum, millet, beans, sweet potatoes, cassava and bananas, and some cotton for cash. Animal husbandry is of little importance mainly due to the presence of tsetse fly.

From Unone, the land rises sharply through steep hills with a lot of river valleys until Mtega area half way the Ukaguru mountains. Mtega village is at an altitude of 1600 m. above sea level and about 69 Km from Kilosa. Mtega village was settled in 1976 and has a population of 1326 people. The village is on the windward side of the Ukaguru mountains. The mean annual rainfall here is between 900 - 1200 mm.

The soil types are dark red and reddish brown sandy loams to yellowish brown sandy loams. The natural vegetation is the upland moist forest on the higher and wetter slopes while Brachystegia woodland occurs on the lower slopes bordering Unone.

The main crops grown are maize, grown chiefly for food but with the surplus being sold, beans, cassava, yams, Irish potatoes, vegetables, bananas, some citrus fruits and a little coffee. Because of isolation and inaccessibility cash crops are cultivated less.

Considerable numbers of sheep, goats, poultry and a few cattle are kept. There is plenty of land available for cultivation and grazing right from Unone on the foot of the mountains up to the hill tops and plateau of the mountain.

There are many river valleys and streams which hinder road construction and together with heavy rainfall cause much amount of soil erosion. No conservation measures are practiced.

From Mtega the road continues to rise up the mountain until it reaches the top plateau 1800 m. above sea level and then begins to fall gently towards Nongwe area. At Nongwe the altitude is between 1700 and 1800 m. Nongwe village is 109 Km from Kilosa. The villages of Nongwe, Mkobwe and Masenge are on the plateau overlooking the eastern slopes of the Ukaguru mountains. Mkobwe is 122 Km. from Kilosa (13 Km. from Nongwe) and Masenge is 136 Km. from Kilosa (14 Km. from Mkobwe). Nongwe is 36 Km. from Gairo and the three villages are accessible from Gairo. At present, there is no access from Nongwe to Mtega except by foot paths through the forest.

Nongwe village was never affected by the Ujamaa Villagization Programme. It existed much before and has a population of 1189 people. It is at the same time a division headquarters. The other two villages Mkobwe and Masenge were settled in 1974 and have a population of 1322 and 2100 people respectively.

The mean annual rainfall of the area is over 1200 mm. and is the wettest area in the Ukaguru mountains. Much of the area between Nongwe and Mtega and the eastern parts of Mkobwe and Masenge is forest area, and is an extension of the Mamiwa Kisara forest reserve.

The soils are shallow, stony dark, greyish brown loams. Soil erosion because of relief and poor communication is a problem. There is plenty of land for crop cultivation and animal husbandry expansion. Also the area has plenty of forest resource potential.

The main crops grown include maize grown primarily for food, sorghum, wheat, beans, cassava, yams, sweet potatoes and Irish potatoes, onions, vegetables, citrus fruits and some coffee. Some livestock (cattle, donkey, sheep, goats and poultry) are kept, but lack of veterinary services and drugs has hindered the husbandry. Wild animals (pigs, baboons and monkeys) cause great damage to crops.

(iii) The Central Railway Line

The Central Railway Line follows the Mkondoa river valley from Kilosa up to Kidete Station. The villages along the railway line are: Munisagara 16 Km. with a population of 1240 people, Mwasa 36 km. with 1137 people and Kidete 42 Km. from Kilosa with a population of 1595 people. All these villages with exception of Mwasa are situated near the railway stations. There used to be a station at Mwasa but it was removed in the late 60's. People along the railway use the train for the transport of the produce as well as for themselves. At Mwasa where there is no station, the farmers have to carry their produce either to Mzaganza or to Kidete on their heads to wait for the train. Train services are open all the year round and travel between the villages and Kilosa urban is easy. However, on some occasions transportation of the produce is halted by the shortage of coaches if the trains come full from Dodoma to Dar-es-Salaam or from Dar-es-Salaam to Dodoma. The people transport their produce either to Kilosa or Morogoro and even Dar-es-Salaam or to Dodoma and Mwanza depending on where there is a good market. Much of the onions grown in the alluvial soils of Mkondoa valley and that which is grown in Lumuma area is transported to the market in Dar-es-Salaam, Dodoma and Mwanza by rail from Kidete Station.

There is little land available for cultivation as much of the surrounding area is hilly and dry. Most of the settlement is concentrated along the valleys on the hill sides. The hill slopes are too steep and quite erroded. The soils vary from shallow dark greyish brown loams on the hill slopes to dark reddish brown loams in the valleys. Dominant natural vegetation is _Acacia-Commiphora_ bushland.

The mean annual rainfall is 600-800 mm. There is considerable soil erosion due to the surrounding steep slopes and low rainfall. This allows cultivation to be carried out only in the valleys and especially in the alluvial soils of Mkondoa and Lumuma river valleys lying between the Rubeho and the Ukaguru mountains.

The main crops grown include maize, paddy, beans, onions and vegetables, Irish potatoes and citrus fruits. The crops are grown mainly under furrow and hand watering irrigation using Mkondoa and Lumuma rivers. However, due to lack of technical know how, water channels taking water to the fields cannot easily be closed to control the volume of water flow, making unnecessary flooding especially during rainy seasons. Such flooding destroys crops and carries away top soils leaving bear sand. Also upper parts of the river valley get little water to irrigate well especially during dry seasons when the water level is low. Thus lack of technical know how wastes much of the water in the lower courses of the river flow and insufficient in the upper courses. Other crops include sorghum, millet, cassava, potatoes, sunflower and cotton grown in the sandy soils on the foot hills adjacent to the river valleys. Animal husbandry is restricted to goats, sheep and poultry keeping due to the presence of tsetse fly in the area. Around Kidete station a few Masai and Kwiva keep cattle. Wild animals (bush pigs, baboons and monkeys) and birds (queleaquelea) cause great damage to crops.

1.7 Objectives of the study

The theme of the study is that feeder roads are important elements in the development of infrastructures in the rural areas. In this study feeder roads are used to find out:

1. The difficulties faced by the farmers in marketing their crop produce and in obtaining agricultural inputs and getting access to sources of farming knowledge and other necessary infrastructures.

2. To examine the socio-economic situation of peasant farmers in the Ukaguru and Rubeho mountains of Kilosa District with respect to the lack of rural roads in the area and to suggest ways of improving their conditions of living.

3. To evaluate the likely impact of rural roads programme in stepping up agricultural production and increasing accessibility to social infrastructures.

4. To analyse the implications of rural roads on productivity of scarce resources, employment generation and distribution of incomes to the people in the area, and finally to suggest ways of increasing agricultural extension services in the area.

1.8 Organization of the study

The main purpose of this section is to give an organizational structure of the work study of the report in the relevant chapters.

Chapter I gives an account of the problems facing the rural areas with respect to the lack of feeder roads. It details a brief description of the study area and specifies the objectives of the research.

Chapter II details the relevance of the rural roads to rural development, it gives a historical development of the transport systems and their role in the development of the Tanzanian economy. It also reviews the road investment appraisal techniques used for road project evaluation in general and the cases applicable to the Tanzanian economy.

Chapter III deals with the research methodology, data collection, and techniques of analysis used.

Chapter IV details the survey results within the farming systems in the study area.

Chapter V deals with the analysis of results of the study in appraisal and evaluation of the Myombo-Kidete feeder roads, and finally

Chapter VI presents discussion, conclusions and recommendations.

CHAPTER II

LITERATURE REVIEW

This chapter attempts to review the importance of feeder roads to rural development. It races the development of the transport systems in Tanzania (rail and road) and how the two have helped in the transforming rural agriculture. Finally the chapter ends up with a review of road investment appraisal and evaluation in general and the Tanzanian approach to road investment appraisal and evaluation in particular.

2.1 The importance of feeder roads on rural agriculture

There is an urgent need to produce more food to feed the rapidly growing world population. The problem is not only that of getting enough food to eat but also that of transporting and supplying it to those who need it most but cannot grow it (Owen, 1965). The Food and Agriculture Organization (FAO, 1963), estimated that the food requirements of the developing nations will grow by a staggering increase of 112% by the year 1985.

In view of the above development policy makers have a vital role to play in the war against hunger in both providing the necessary roads and transport facilities and services, and by contributing to wise investment decisions in related areas to ensure adequate food supply.

Industrialization and urbanization are contributing to faster population growth while rural urban migration is contributing to slow food production. More food production is needed in the rural areas and means of transporting it to the consumers are lacking. There is also a gradual disappearance of unused land in most parts of the world. The principal means of increasing food productivity is by applying fertilizer, seed and insecticides and mechanical equipment to existing cultivated land. This means improving road networks, extensive investment in trucks, expansion of storage and processing facilities, and new institutional arrangements for managing and financing the total system (Mecall, 1977). Rural feeder roads are among the means by which the world food demands can be satisfied. The relationship between good feeder roads and the ability to grow and market food has been demonstrated in many parts of the world.

In Bolivia, the highway from Cochabamba to Santa Cruz reduced travel time in the rainy season from several weeks to fifteen hours and provided a link between the country's food supplies and its peoples (Owen, 1965).

Achieving "a yield per hectare take off pre-supposes improved feeder roads and rural transport (Brown, 1965). Where rural roads and rural transport have been added to the other ingredients of a successful programme for food and agriculture the results have been rewarding. India, China and Pakistan which account for 60% of the total population of the underdeveloped world are now almost entirely dependent on more intensive cultivation of land already being farmed by applying the package approach (fertilizer, seed and insecticides). In Ludiana District of the Punjab State of India where the package approach has been applied, yield per hectare increased by 40%, the area under cultivation grew up and total output expended by 68% while consumption of the chemical fertilizer increased five-fold in three years (I.A.D.P., 1964). In Tanzania between 1945 and 1960 there was a twenty-fold increase in the tonnage of fertilizer imported most of it used by estate agriculture growing sugar, tea, sisal and coffee which had feeder roads leading into them (Jones, 1961).

In some countries where rural roads have been lacking and where fertilizer, seed and insecticides cannot be obtained efforts to produce more food and market it have been frustrated. For example the State of "Uttar Pradesh" in the Gangetic plain, where one-third of India's wheat is grown, is a food deficit area despite good soils and the availability of substantial ground water resources. The reason being the extreme difficulties of marketing crops or of obtaining needed inputs in an area where farmers are miles away from an important market and often far removed from a road (Owen, 1965). High cost of rural mobility and inaccessibility limit the quality of agriculture hence rural development.

It has not been possible for farmers in areas without rural roads and rural transport to break from traditional patterns of production to producing for the market. Farmers find difficulties in plant protection measures and fertilizing due to infrequent deliveries and unreliable schedules. A small percentage of high school age children are able to get to school. Literacy workers shun the villages that are poorly served by roads, agricultural extension workers find it either time consuming or impossible to visit farmers on foot along uncleared paths (McCall, 1978 and Owen, 1965). The people in such areas suffer from food protein deficiency, ideal water supply; health and all other nutritional services. In short they lack co-operative organization, lending and marketing institution, cannot uncover significant skills and leadership qualities among themselves and as such they cannot plan for their self actualization and esteem (Gilbert, 1965).

It could be rightly said therefore, that rural roads are among the factor variables that help to bring up rural development. They attract inflow of infrastructural services such as health centres, schools, marketing institutions and leading institutions, and are able to attract the use of fertilizer, seed and insecticides. Provision of feeder roads therefore assist in transforming traditional agriculture into modern agriculture, hence increased income per capita and high quality food consumption.

2.2 The development of the transport system in Tanzania

Transportation is a wide ranging phenomenon, linking together various places and sectors of the socio-economic structure (Mkama, 1969). In Africa, the forces that have influenced modern development entered through the sea ports. Yet the present progress of the African economic development has not reached a stage where internal trade rivals external trade in quality and volume. The developing countries of modern Africa are markedly orientated through the sea ports towards export markets and sources of imported goods (Ogot, 1969).

The first modern transport system to be established in Tanzania was in 1870's. In 1876 Mackinnon and Buxton undertook to construct a road from the Indian Ocean port of Dar-es-Salaam to Lake Nyasa in order to open up the country to modern commerce to replace the slave trade. The road extended seventy three miles inland and was rendered inactive by the presence of tsetse fly. Attempts to use bullocks for transportation also proved unsuccessful (Smith, 1958).

The next attempt to open up the mainland was when Seyyid Majid the Sultan of Zanzibar granted Mackinnon and friends a concession to regulate the navigation of rivers and lakes and to construct roads, railways and telegraphs (Coupland, 1968). The scheme never took off. The actual start of the modern infrastructure took place after 1896 when East Africa was partitioned by the Heligoland Treaty which gave Tanzania to the Germans. The Germans concentrated on building railway rather than roads.

2.3 The development of the railway

The Germany East African Company built the first railway line from Tanga to Moshi between 1896 - 1911. The completion of the line was delayed by shortage of funds until the German Imperial Government which had little interest in it, came to the rescue of the railway and constructed the line.

Between 1900 and 1914 the Central Line from Dar-es-Salaam to Kigoma was built covering a distance of 780 miles. This line has remained the most important undertaking in the railway history of Tanzania (Eberlie, 1960).

Other lines to be built were the Tabora to the south-west of Lake Victoria and to Ruanda and Burundi, and the line from Kilosa to Iringa and subsequently to Mbeya and Mbozi. This project was halted by the outbreak of the First World War.

The war severely damaged both the Tanga and the Central Line during the Germany retreat. Thus the first task undertaken by the British Colonial Administration was to rehabilitate the railway (Gillman, 1942). Between 1925 and 1966 a total of 851 miles of railway were built. The lines constructed during this period are shown on Fig. 3. Some of the lines proved uneconomical and were removed. The Manyoni-Kinyangiri line intended to stimulate growth in the now Singida region removed between 1944 and 1947 was a case in point (O'Connor, 1965). Also a southern line was built simultaneously with Mtwara port as part of the groundnut scheme. After the scheme was abandoned the line was retained with a hope that it would stimulate rapid development.

Between 1955 and 1960 the line operated at an overall loss of between £210,000 and £250,000 per annum. The loss was met by the Tanganyika Government as a subsidy to the railway administration until its removal in 1962. Also the Central Line to Kongwa was removed and replaced by a road.

The German Administration had constructed the railway for the purpose of opening up new sources of raw materials and markets for manufactured goods, side by side with the economic motives were the strategic considerations influenced by the scramble for East Africa. The building of the railways assisted in the establishment of plantation agriculture. However, no efforts were made to open up the rural sector so as to transform it from a subsistence to a market sector.

During the post war years, motives were to construct railways to open up new areas for agriculture and mining. Mwanza and Mpanda lines are cases in point. The railway helped to promote a dual economy where rural agricultural potential areas were tapped of resources meant for the export market (Ominde et al., 1971).

Until 1948 Tanganyika railways were faced with financial and administrative problem. The debts incurred were off-set by the amalgamation of the railways with the Kenya-Uganda railway to form the East African Railways administered by the former East African High Commission. The amalgamation indeed saved the Tanganyika Railways from severe financial problems which were due to:

1. The loss of copper traffic from the Congo which had been diverted from Dar-es-Salaam port to Lobito in the 1930's.
2. The loss of import and export traffic which was moved along the Kenya-Uganda line.
3. The heavy burden of the railway debt.

Operation and maintenance of the railway had drained the meagre resources of the country. The amalgamation eliminated the burden of subsidizing the railway; freed the government from providing railway facilities, and helped the government to attend to other transport facilities. This amalgamation helped the government to recover £414,000 which had been loaned to the Railway Department (East African Royal Commission Report, 1955).

The Ruvu-Mnyusi line was built to link the main lines of East Africa (Kenya-Uganda line, Tanga and the Central line) so as to enable the transfer of wagons from one line to another. It was hoped to save £555,000 per year by enabling a more efficient distribution of the railway wagons (IBRD, 1961).

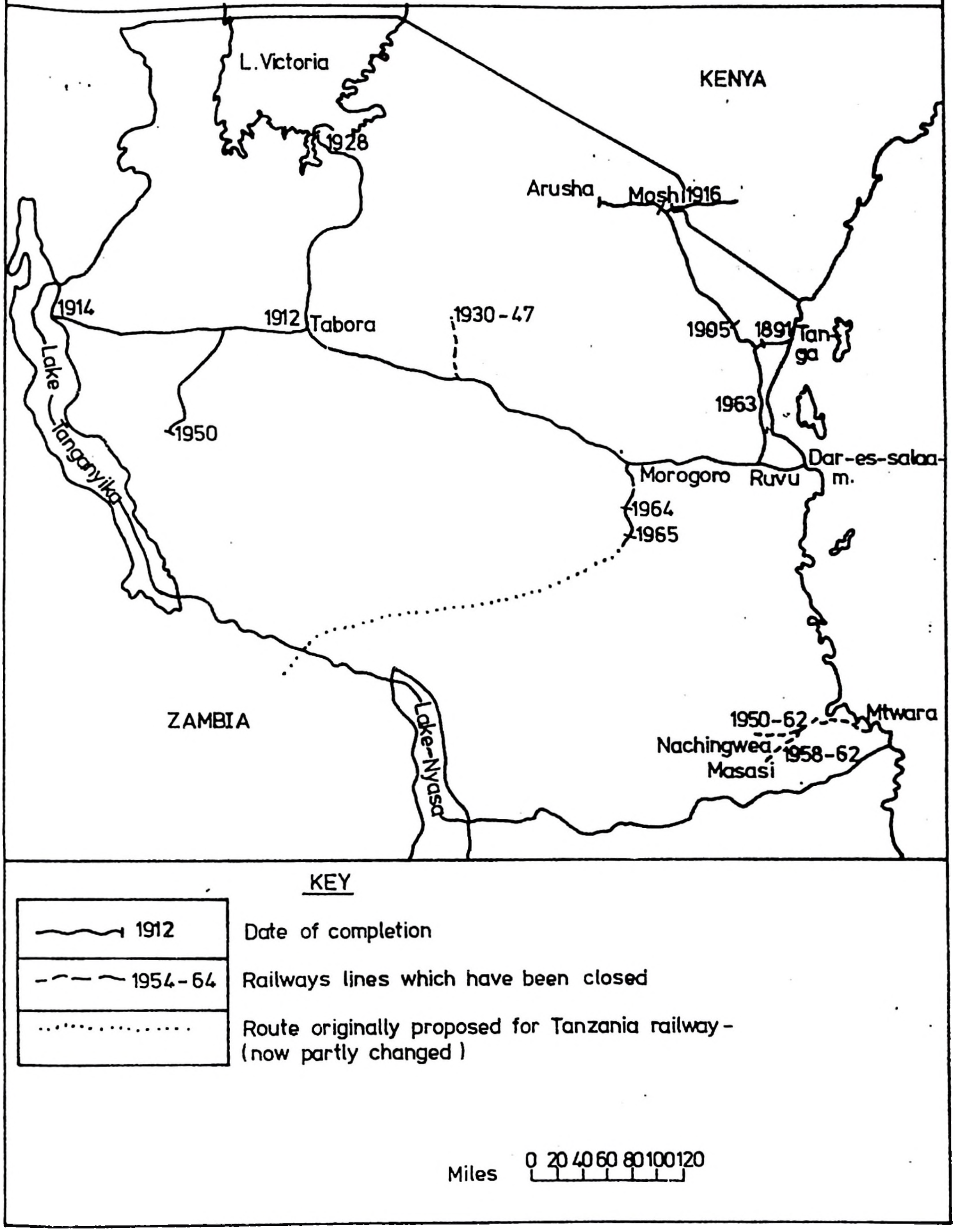
Other lines built were the Mikumi Kidatu extension which was intended to provide access to the fertile Kilombero valley in the Rufiji River Basin. This branch was proposed to link up the new line between Tanzania and Zambia (TAZARA). This link was discouraged by the expenses foreseen in transhipping goods from wagons at Kidatu due to the difference in the gauges. This led to the building of the Zambia railway line from Dar-es-Salaam port (BRALUP, 1969).

The railway development in the country has in no way helped to establish a link between the rural areas and the urban centres. It only assisted in widening further the dual economy. Its significant development can only be realised in areas of cash crops which are on the peripheral edges of the country. The railway links a few areas of the country i.e. the north eastern, the lake region and the central areas (See Fig. 3). Where rural feeder roads have been provided the policy has always been attached to the developmental projects such as a high value agriculture, mining or irrigation. Feeder roads that have existed demonstrate a bias towards the export crop producing areas. Examples are the cotton roads in Gaita, tobacco roads in Tabora, tea roads in Rungwe, sisal roads in Morogoro and cashewnuts roads in Mtwara all funded by the World Bank and other agencies (McCall, 1981).

The problem became more urgent in view of a change in government development stategy to concentrate on rural development after the Arusha Declaration in 1967.

After the Arusha Declaration attention was turned to District and Regional Committees throughout the country to plan their rural feeder roads. The Regional Planning teams and Regional economic secretaries evaluate and select projects. Interministerial Road Committees allocate available sums region by region in

FIG. 3. RAILWAYS BUILT BETWEEN 1894 AND 1964



accordance with agricultural and regional planning priorities. Each Region implements its own feeder road projects and of the finance from the Regional Development Funds (Second and Third Year Plans, 1969-74 and 1976-81). Each region was to be provided with a team of builders whose duty was to construct and maintain bridges and culverts, and maintain the roads. It was further required that in each Ujamaa village there be a concrete work programme indicating the distance on the road to be maintained by every working person in the village.

This policy did have some shortcomings:

1. The Regions had multiple projects with conflicting priorities and had limited funds to finance such projects.

2. The regional feeder roads are maintained very irregularly only when they become impassable. The majority of unclassified roads and tracks are hardly ever maintained.

3. The Regions have always lacked equipment for supporting the gang working on the roads, i.e. tippers, graders and tractors.

4. Regions lack experienced technical staff and technical advice and generally have poor organization and supervision.

5. Rural feeder roads are always poorly maintained. Village members who are supposed to maintain the roads, put their emphasis on producing enough food for their families before they can attend to any other projects. Since most of the time the farmers are busy in the fields, they hardly get time to work on the roads.

2.4 Road transport and road development in Tanzania

Tanzania's road development can be traced back to the colonial period. When the scramble for East Africa was at its climax. The German Colonial Administration did not carry out any important road development. Efforts were concentrated on the improvement of bridges, ferries and rest houses on the important caravan routes, as well as settling soldiers on small holdings which supplied food to travellers (Harlow, Chilver and Smith, 1965).

During the First World War, roads were made by improving tracks made hurriedly to facilitate the movement of war supplies. Immediately after the war, lack of funds made any extensive road programme impossible. Despite poor road conditions, road transportation began to assume importance after 1930 (Mkama, 1969).

By 1936 long distance porterage had almost disappeared as buses and lorries became a familiar feature in many areas. In 1936 the country had 13,928 miles of roads (See Table 2.1). Some of the important roads which had been constructed by this time included the Great North road which was completed in 1932, the old Dar-es-Salaam - Morogoro road and several minor roads providing access to gold mining areas in Mpanda, Musoma, Geita and Chunya (Moffet, 1958). By 1945 only a rudimentary road system had been developed, largely on an unplanned basis.

A definite policy on road development came into force with the adoption of the First Colonial Development Plan in 1946. Two important factors contributed to this: Firstly, the failure of the Manyoni-Kinyangiri railway led to the belief that road construction provided a less expensive method of opening up new areas for development (Development Plan, 1955-60). Secondly, the transfer of responsibility for constructing, running and maintaining the railways to the East African High Commission in 1948. The Government contribution to provide communications was confined to road development. The objectives of the policy pursued after 1946 was to provide a country-wide "low-cost road" system.

Table 2.1. Tanzania: Roads existing in 1936

Township roads	213 miles
District Headquarters roads	97 "
Main roads	2784 "
District roads Grade A	1478 "
District roads Grade B	9356 "
Total	13928 miles

Source: Economic Survey of the Colonial Empire London, 1936.

A low-cost road was defined as one which "having regard to considerations of climate and traffic, has been located and built to geographic standards commensurate with future requirements, but has been constructed with bases and surface to meet the present traffic requirements. It is, however, one which should be so designed, constructed and maintained that it allows for stage construction when traffic requires it and improvement in economic conditions permits" (Development Plan, 1955-60).

This policy of providing country-wide low cost roads has been pursued to date. In pursuing the policy the aim has been to build up a road pattern in the form of: "a grid of trunk roads, four running north to south, and three from east to west. To these trunk routes main feeder roads must be provided and to these latter district roads to the outlaying markets and productive areas" (Development Plan 1955-60).

The grid, which is now more or less in existence, has been developed in such a way that it complements the railway which runs from east to west.

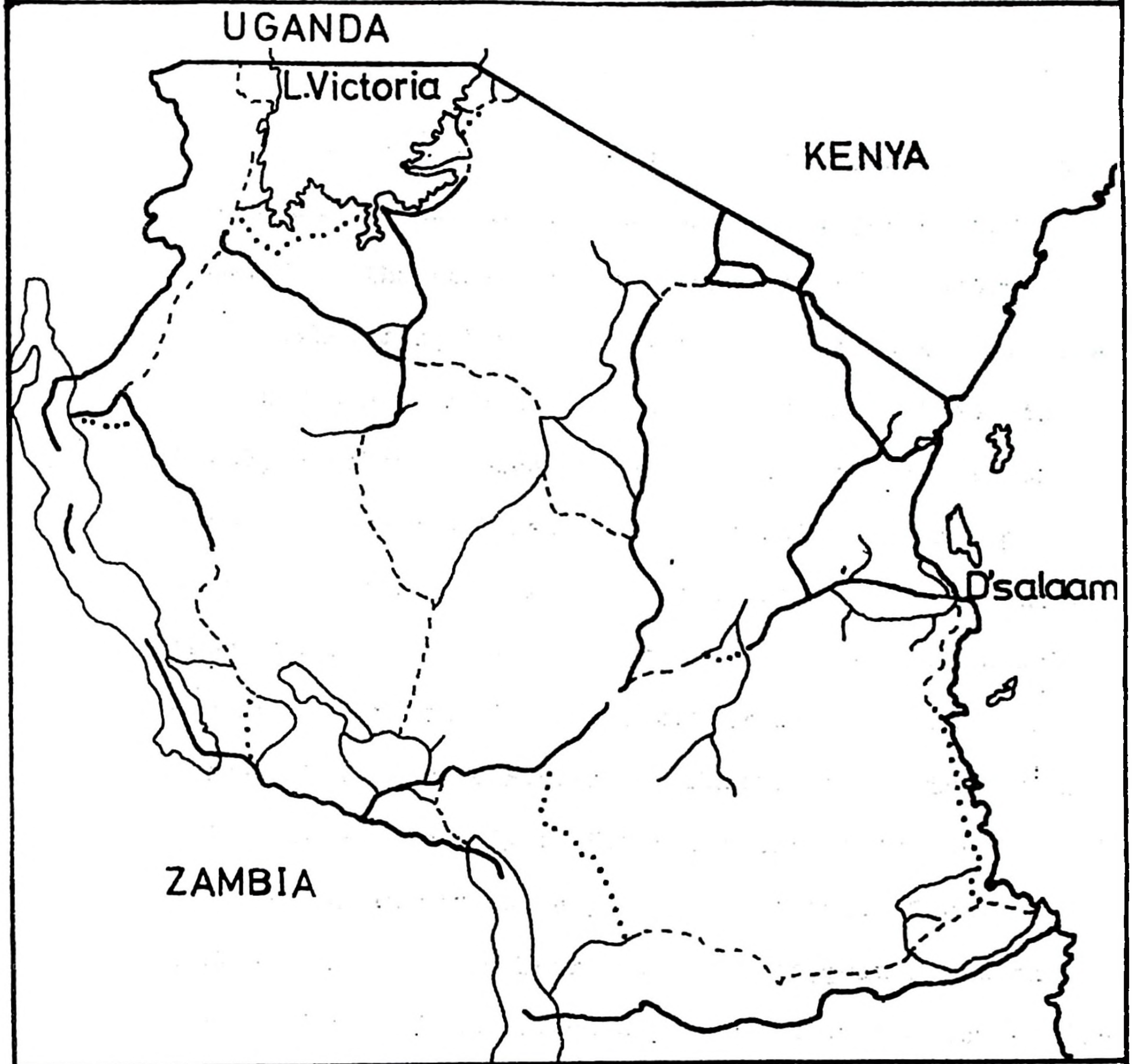
In the 1955-60 Colonial Development Plan a total of about £4.3 m. was set aside for expenditure on the development of roads. Trunk roads were to account for £2.2 m., feeder roads were allocated about £1.3 m. and the balance of about £0.8 million for urban and unforeseen roads.

By the end of the plan however, £0.2 m. more had been spent due to rising cost of building materials, labour and other factors which were unforeseen at the beginning of the plan. Thus the expenditure on road development between 1955 and 1960 was £4.5 million. The main feature of development during this period was the improvement and upgrading of existing roads rather than the construction of new ones. The pattern of the trunk roads proposed in the plan is shown in Fig. 4.

From 1950 onwards there was an average annual increase of about 345 miles of classified roads. The total mileage of classified roads thus increased from 17012 miles in 1950 to 20464 miles in 1960. The local main roads increased by about 2121 miles, territorial roads increased by 735 miles, and district feeder roads increased by 340 miles. The rapid increase of local main roads was largely for administrative reasons rather than for encouraging agricultural development. This resulted in a lack of feeder roads linking them to the rural areas.

The view of the Government at the time of implementing the Three Year Plan was that the existing main

FIG.4–DEVELOPMENT & IMPROVEMENT OF TRUNK ROADS 1955–60



Existing main roads

Existing roads at lower standards proposed for upgrading into main roads

Proposed new main roads links

Other existing roads

road system was incomplete in the sense that it looked outwards. It encouraged the outflow of purchasing power from the more developed parts of the country to the neighbouring countries, particularly to Kenya. The system did not provide direct connections between the highly developed zones within the country, namely the Lake Northern and Coastal zones as well as linking them with the major sea ports in the country. In the later case, this was particularly true of those areas which had no direct rail link with either Dar-es-Salaam or Tanga. For example Bukoba and Musoma in the Lake zone had to depend greatly on Kenya and Uganda for the movement of import and export commodities. Thus, implied in the Three Year Plan road programme was the elimination of this deficiency as well as the connection of areas of agricultural and mineral production with the major outlets in Tanganyika (Mkama, 1969).

The implication of pursuing this policy on the development of the transport system and environment were two-fold: Firstly, it reflected concern on the part of the Government of a new nation to reorientate the transportation system to the internal needs of the country, and to provide adequate transport facilities in areas which were developing very rapidly and those with promising potential for future development. Secondly, it recognized the growing importance of road transport, which was to be encouraged to play an equal or greater role than that of the railways. This marked a departure from the past policies which avoided providing direct road connections to sea ports, to discourage competition between rail and road (Three Year Plan 1961-64).

The Policy of concentrating on the provision of main roads and the expense of feeder roads was hailed by the World Bank Report which remarked in 1961:

"Up to the present the Government's policy has been to build up the main roads system to all-weather standards passable at all seasons, and to attend to feeder roads improvement on a strictly limited scale. This was the right policy to start with; a feeder road could serve little purpose until the main road could take its traffic. The alternative of providing a complete system of main and feeder roads, area by area, would have prejudiced the economic development of the important areas of the territory and would have severely hampered administration" (IBRD, 1961). This policy and the World Bank Report did not take account of the population and economic activities of the country located in the peripheral areas or "Islands" isolated by vast areas which are sparsely populated. The policy should have been to continue providing a reliable transport system in the centres of economic activity. Providing and spreading scarce resources over vast areas would lead to providing transport facilities which would be under utilized in less developed areas, and inadequate in more developed areas. Thus, at the time of independence the country had a sizeable infrastructure which was not closely related to the needs of the local economy (Mkama, 1969).

The emphasis put on developing trunk roads in the first three years of independence contradicted the World Bank Report of gradual reduction of major roads and the stepping up of the development of the feeder roads. The First Five Year Plan 1964-69 set up four objectives to guide further development of road communications.

(a) The trunk and major link roads were to be developed as necessary to meet traffic requirements.

(b) The construction or improvement of major feeder roads was to provide for the economic transport of an ever increasing quantity of the produce and other goods.

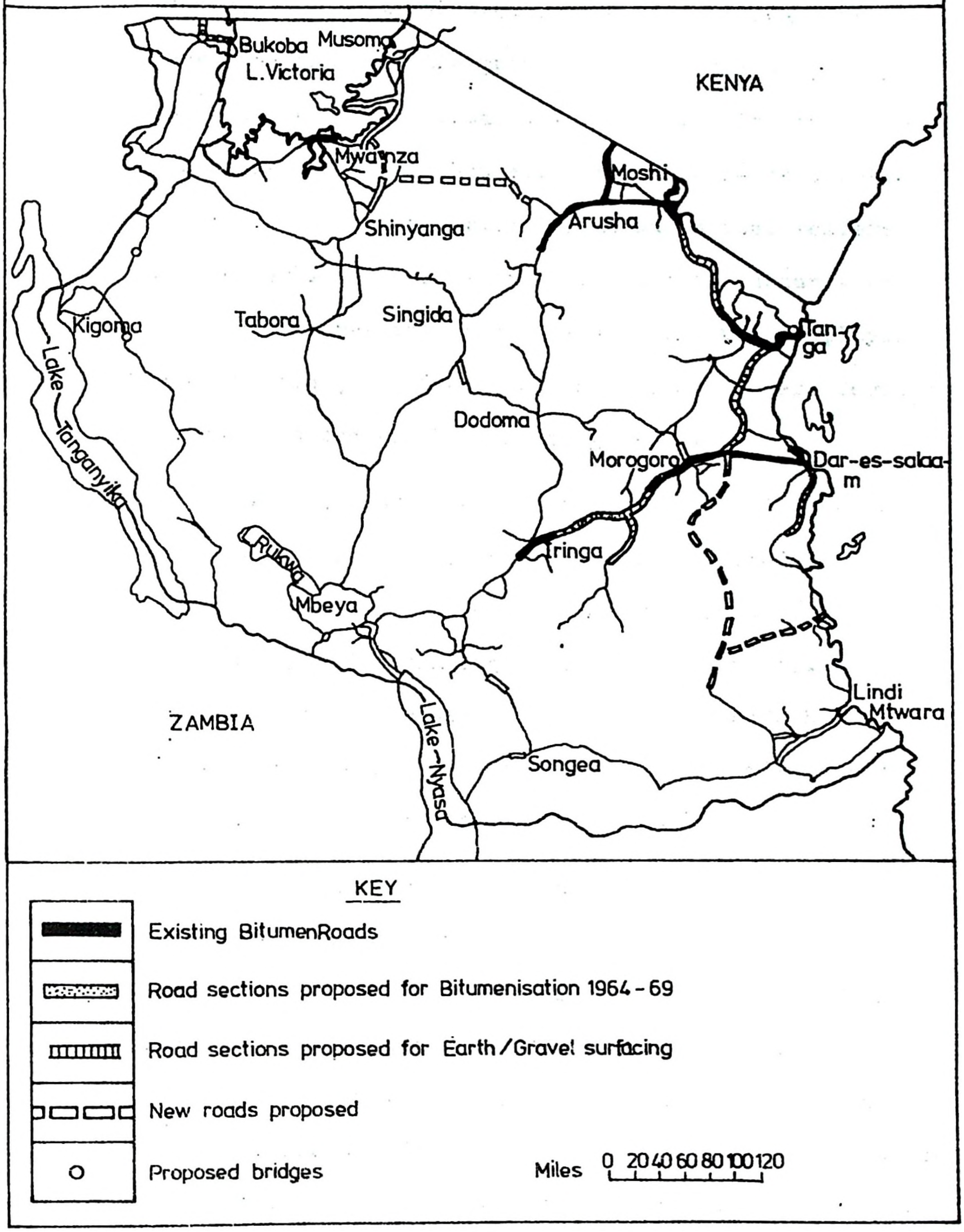
(c) Construction or improvement of minor feeder roads was to provide satisfactory access to developing areas.

(d) To ensure the economic soundness of each major project, preliminary feasibility studies were to be undertaken as required (See Fig. 5).

Over £15 million were allocated for the roads in the First Five Year Plan. £2.1 million had to be carried over from the Three Year Plan. Of this total about £3.7 million was to be spent on major roads, £1.5 million on major link roads and about £5.9 million on major and minor feeder roads (First Five Year Plan, 1964-69).

The First Five Year Plan like the Three Year Plan lacked finances to carryout the proposed projects. Attempts to keep the southern sections of the Great North road and the Southern Trunk roads in good condition to maintain the movement of goods to and from Zambia, increased the amount of funds spent during the plan period. The problems associated with the above policies were many and uneconomical to the development

FIG. 5. DEVELOPMENT AND IMPROVEMENT OF ROADS DURING THE FIVE YEAR PLAN 1964 - 69



of rural agricultural areas. The kind of road system developed promoted the problem of regional disperity which was both horizontal and vertical. It was horizontal in the sense that some regions were made better off in terms of per capita income and social welfare than others. It was vertical in that the urban areas were made richer in terms of availability of employment opportunities, services, income levels and were developing faster than the rural areas in general.

Also the Government financial capability has not been sound enough to provide good feeder roads. Local resources available have continually been used for maintaining and upgrading existing trunk roads. Consequently the construction of feeder roads has depended on the availability of foreign capital in form of loans and grants (Hofmeier, 1973).

There has also been an apparent lack of trained personnel (engineers and surveyors) to help in route selection and designing feeder roads projects. This has been coupled with lack of information about transport needs in the rural areas because of lack of a research body to collect information on transport needs and costs in different parts of the country (Mkama, 1969). There has not been a clear policy on feeder roads.

2.5 Road investment appraisal and evaluation technique

Road investment project appraisal and evaluation is a difficult technique. There is hardly any universal convention of appraising and evaluating road investment projects. Different countries use different types to appraise and evaluate different types of roads in different economies. There is never enough reliable information about the past and the present, and hence forecasting is difficult. Using transport may be one of many factors but the reaction of farmers to a new road is uncertain, and shadow prices may be only informed guesses (Adler, 1967).

The objectives of road appraisal and evaluation is to assess the estimated costs against estimated benefits. Generally if benefits outweigh the costs, the road is considered worth building, but more often the feasibility studies look at a series of possible projects and rank them according to the ratio of benefits to costs. Projects with higher ratio of benefits to costs are given higher priority since they offer the greatest returns to the government's investments. Most feasibility studies are concerned with the upgrading of existing roads or tracks to feeder roads standard to make them all-weather roads rather than with constructing new routes (McCall and Skutsch, 1978). Since evaluation of feeder roads is intended to stimulate agricultural projects without incurring heavy capital expenditures, agricultural specialists who identify rural projects should know how to put roads into them. They should also know what questions to ask highway engineers and how to calculate road benefits and their justifications (Jones, 1970).

In the section below different conventional techniques of road project appraisal and evaluation are reviewed and their relationship to Tanzanian approach are considered.

2.6 Review of analytical techniques

The conventional criteria used in road project appraisal and evaluation are:

(a) Road-users savings or benefits

(b) Road maintenance costs

(c) Time savings

(d) Comfort and convenience

(e) Accidents reduction and

(f) Economic development benefits.

One or more of these or a combination of all of them can be used to assess the worthness or the profitability of a road project.

(a) Road-user savings: These are the reduction in operating costs felt by road users upon the road improvement i.e. less petrol/diesel is used, vehicles need less maintenance etc. This criterion calls for a thorough knowledge of the road surface conditions, the types of terrain and soil moisture content. It also requires a thorough knowledge of the differences between regional and local operating costs. The road-user savings considered are primarily the present and the future user savings over a decade or so. Such user savings call for upgrading of existing earth surface roads to engineering gravel surfaces or bitumen standards. The method does also require estimates on reduction in operating costs of petrol, vehicle maintenance, depreciation etc. to the individual road users. In estimating such reductions, different operating costs are assumed and calculated separately for different types of user vehicles (cars, motor cycles, landrovers, buses, lorries and trailers). The vehicle operating costs (VOC) savings presupposes a competitive environment in a free market.

In some developing countries such as Tanzania, a free market economy does not exist. Without a free market, it is hard to attach the right prices to vehicle operating costs whether shadow prices or otherwise. Distorted market prices because of an uncompetitive environment presents different values for VOC savings. When such savings are wrongly presented they produce a false picture on agricultural benefits of assumed production.

In calculating the VOC savings on the major feeder roads, some evaluaters use savings derived from the differences between VOC on an earth surface and on a bitumen surface. This approach requires variables on traffic flows and VOC savings before and after the investment, which calls for an up-to-date traffic counts on the road.

The problem with this method is that it is appropriate for primary roads in areas where the level of economic activity is already substantial. It does not take into account of the subsistence nature of the economy that exists in most rural areas of the less developed countries. The criterion is in-appropriate for areas in which there is little traffic on the roads and low levels of economic activity. Using such a criterion presents a false picture for rural roads in a subsistence economy with little or no traffic on the road.

(b) Road maintenance costs: This method assumes that for a properly designed, graded and surfaced road the costs should be lower. Many road consultants give widely varying views on this criterion. Some do assume lower maintenance costs on improved roads than on the surface roads (especially when the road is under consideration for upgrading to bitumen standards). Others assumes higher maintenance costs on gravel roads than on earth surface roads, while others treat these cost savings neutral (Ngila Mwase, 1978).

It is often assumed that the amount required for maintenance costs is quite small in relation to total benefits and costs. The factor usually overlooked is that road maintenance costs especially recurrent costs deserve greater attention as it is often a significant bottleneck.

(c) Time savings: Time savings is calculated in terms of travel time reduced upon road improvement. The reduction in time spent travelling on an improved road is considered to be a benefit to the road users.

Time savings are difficult to forecast and value, and in most cases this factor is often ignored. Time savings are usually calculated using opportunity cost of labour. In such a case, time saved is undervalued since the opportunity cost of labour in a subsistence economy is given very low or zero value. Again the people moving on the roads include peasant, holiday makers, traders, organizers of various enterprises and government civil servants. Road evaluaters do not make any distinction between these types of people moving on the roads. In short, there is no any agreed upon formula on estimating time savings.

(d) Comfort and convenience: Comfort and convenience are expected to increase with the upgrading or improvement of the road. It is more comfortable to travel on a well designed, graded and surfaced road. This criterion is very hard to quantify in monetary terms and it is rarely applied in road appraisal and evaluation.

(e) Accidents reduction: Forecasting the effect of investments in roads on accident rates is extremely difficult to make. It is even more difficult to put any monetary value on reductions in fatal and non-fatal accidents. Some evaluators attempt to assign numerical values to accidents reduction upon road improvements. They also attempt to assign such reductions some monetary value. It is hard to forecast the amount of fatal and non-fatal accidents likely to be reduced as a result of road improvement. Unless such costs and benefits are based on the government's "revealed preferences" on value of life, they are often very low, according to some economists such as Prof. Jones-Lee. In some cases well designed roads cause more fatal accidents than rough roads due to overspeeding and traffic volume on the well designed road. Drivers are less careful on smooth-straight roads, making more accidents than on rough roads. Little is known about the rates of accidents that are likely to occur under different conditions. The accidents costs seem to be too low vis-a-vis total costs of the road improvement especially for the bitumen roads.

(f) Economic development benefits: Economic development benefits (Agricultural benefits) are the most significant benefits, and the main reason why feeder roads are constructed.

In the development economies literature, reference is often made to the external or developmental benefits of transport, especially road transport, including economic growth and development. According to W. Arthur Lewis (1955), "a cheap and extensive network of communications is the greatest blessing that any country can have from the economic point of view".

The evaluation of these benefits, especially the agricultural ones, is the most critical stage in cost-benefit analysis (CBA) of road projects. In the developing countries benefits derived from (VOC) savings are small for rural feeder roads because of the low traffic volume. Most of the benefits calculated for rural feeder roads include induced production benefits, agricultural benefits, developmental benefits and possible social and political benefits. It is quite difficult quantify to agricultural benefits or developmental benefits. Sometimes such benefits do not have a meaning. For several reasons it cannot be certain to know how much will be produced as a result of road improvements.

(a) It is hard to forecast the elasticity of production in respect to transport costs. Factors such as the economic development potential of an area, its structure, market conditions, sociological components - e.g., the population response to such transport economic impulses, matters of an institutional nature, etc. must be considered.

(b) In transport constrained areas increased production may follow improved roads, but the increase if any will be negligible for isolated road projects unless there is an integrated package. The problem here is that of supply response which is often treated as a short-run phenomenon. Improved production and exchange may occur in activities which do not exist when the project is being evaluated. When evaluating agricultural benefits resulting from road improvement, consideration should be made on the variation of regional and local differences in agricultural potential and varying market projects for the crops grown.

Majority of projects evaluated rely heavily on "border prices" which often fail to quantify the social benefits and costs involved in the use of tradeable and non-tradeable commodities. This is the reason why less developed countries have concentrated on the export production and import substitution. Such method does not tell exactly whether food crops not brought in the market are induced by the presence of the road (Ngila Mwase, 1978). In order to measure the elasticity of production in respect of road improvements, other factors such as the economic development potential of of an area, its structure, market conditions, sociological components -- e.g., the population response to such road economic impulses, matters of an institutional nature etc. - - must be considered.

2.7 The Tanzanian approach to road project appraisal and evaluation

Economic analysis in the appraisal and evaluation of road investment project especially that of feeder roads is a relatively recent phenomena (Ngila Mwase, 1978). According to the World Bank (1974), the problem of assessing feeder roads is essentially one of measuring the response of output to changes in transport costs along with and relative to all other inputs, such as land clearence, settlement, fertilizer, seeds, insecticides, storage and marketing facilities. In addition, countries such as Tanzania would like to assess road projects on account of economic, social and political aspects of project's benefits. Of the several approaches that have been carried out in other countries, very few have succeeded in Tanzania.

Israel (1970) used a linear programming approach to the problems of project appraisal of feeder roads. His method is very flexible and can be applied to a wide variety of situations under a range of conditions.

But it requires rather complex computations and computer processing which makes it less desirable for application in the state of economies of most developing countries such as Tanzania.

An IBRD transport economists team (Carnemark, Biderman and Bevot) has developed a producer surplus-based approach. This method, despite its relative comprehensiveness is not attractive for Tanzania-type economies for it requires extensive data on farming patterns, population, per capita consumption and production costs; altogether with forecasts of a variety of variables over the project life time; and extensive use of computer processing. An appropriate approach for a rational selection of which roads to improve taking into account economic as well as socio-political criteria (and scarcity of funds), has not easy to use since few been computational facilities are available.

Stanley (1971) developed a weighted rating method for appraisal of the farm-to-market feeder roads. In his Liberian case study he does not give traditional measures of economic efficiency such as internal rate of return (IRR), but presents a priority listing for the improvement of roads, based on both economic and social factors. He considered factors such as population growth, potential for agricultural production, cost of construction, connectivity value and administrative factors.

In Tanzania road appraisal considers in addition to the variables considered by Stanley, density and quality of road network, traffic volumes and trunk road connections, access to social health and market centres, differences in regional standards of living, and local response to road improvements (Second Five Year Plan, 1969-74).

It is worth noting that of the several approaches carried out in road feasibility studies in Tanzania, few have proved successful. The first road project study which could be said to amount to a feasibility study was that of Bunda-Nansio in the Lake Region carried out by Ralph M. Parson's and Company in 1963. The method applied by Ralph M. Parson's and Company represented a major advance over earlier methods of project appraisal ever used. The method used traffic volumes adopted on an average of the Ministry of Communications and Works (Comworks) traffic counts and estimates based on agricultural produce purchases in the area. Ralph and Company assumed an estimated annual traffic growth of 8½%.

In their method, Ralph and Company compared the net benefits which were based on amortization of a loan at 3½ per cent interest rate over a period of 40 years.

The Bunda-Nansio road project appraisal like any other projects carried out in the country failed to show or set out the range of social benefits likely to result from the road project.

Sir William Halcrow and Partners (1966) on Cotton Roads in Geita District used road user savings on generated traffic as a measure of the extra effect on development. BRALUP (1971) report on Geita roads attempted to estimate the extra production of cotton above the normal rate of growth in the region as a whole, that would result from the road improvement. Use of induced agricultural production was made to provide the major justification for the investment.

The United Research Institute (URI) 1971, in evaluating the Basotu-Katesh road in Hanang District and a number of roads in Mara Region, Mbulu District, Lushoto District, Njombe and Rungwe Districts and Morogoro District considered the roads as an integral part of a wider development programme from these areas.

Mara Regional roads were part of a programme of small-holder dairy farm production, whereas the Basotu-Katesh road was for the development of a large wheat estate farm. The cost of these roads were added to the total costs of the development programmes and compared with the returns on the total projects.

The choice of the areas where the roads were built was based on the production potential, crop priorities and adequacy of existing transport facilities. The roads were justified on the basis of road-user savings, with savings accruing to induced traffic representing the minimum developmental effects. Salvage values were made on major drainage structures and maintenance savings (McKay et al., 1971). Most of the roads were considered for improvement to engineering gravel standards. But of all the feasibility studies carried out, none has been able to provide a uniform standard of cost estimation techniques to be used throughout the country. There should have been a complete assessment of trucks which are used to evacuate the produce from the villages where feeder roads are built. The trucks assessed to evacuate the produce from the villages go to them empty. Trucks which deliver inputs i.e. fertilizers, insecticides and seed to the villages return empty. The analyses should have drawn attention to the apparent wastages. Most of the projects appraised should have indicated into their analyses the cost of building village store-houses for crop inputs and crop harvest. A storage component would reduce traffic on the roads, hence user-cost savings and the rate of return. At the margin, fewer roads would be built, but more storage facilities would be built. The combination of storage and fewer roads would be better for the country than larger number of roads without storage (Jones, 1970).

It appears that all the Tanzanian feeder road projects have been concerned with cash crop projects. These cash crop projects have not incorporated employment generation, self-sufficiency and local industry assessment. Little emphasis has been put on the utilization of local labour resources in the construction of such roads. All the feeder roads have utilized capital intensive methods which drain scarce foreing exchange and not solve the unemployment problem (McCall and Skutsch, 1978). If feeder roads were to be orientated to the utilization of local labour, peoples' purchasing power would be boosted and more use of local tools would be made.

CHAPTER III

RESEARCH METHODOLOGY

The general location of the two feeder roads and the Central Railway places the study area into three sub-study locations (See Fig. 2). It was felt necessary to treat each location separately putting into account the nature of the transport along each route, crops grown, livestock kept and the general climate of the area. It was then decided to carry out the survey in thirteen villages (four along Myombo-Kidete, five along Rudewa-Nongwe feeder roads and four along the Central Railway) All the villages are Ujamaa villages. As it turned out all the villages kept a list of village farmers. The criteria for selecting the farmers for interviews were more narrowly specified. Selection was restricted to farm operators, those who actually made the day-to-day decisions on the farm and who were responsible for the family (married with children, widows/widowers, divorced/separated) at the time of the data gathering. Young men and women who did not fall under any of the above categories were excluded from the sample. It was then decided to choose a sample of 10 farmers at random out of each village, thus giving an initial sample of 130. The chosen names were then given to the village chairmen or secretaries to help in locating the farmers.

3.1 Data source and collection

Data for the study were obtained by visiting farmers and holding personal interview. The recording was done by questionnaire. Questions had been phrased to elicit the desired information. Two types of questionnaires were used.

1. Single farmer interview questionnaire,
2. Group interview questionnaire.

The single farmer interview questionnaire was used to gather information about individual farmer; his age; family size and labour force, sources and uses of income; crops grown on the farm and farm size; food preferences; farming experience and years of stay on the village; sources of inputs; marketing channels; transport facilities and the distance from the village or farm to the market or buying centre. Ten single farmer interviews were conducted in each village making a total of 130 interviews.

The group interview questionnaire was used to obtain information about the village; population and population structure; village history and set up; village infrastructures; village problems and development strategies. The group interviews were held one in each village, totalling to 13 interviews. The interviews were held with the village chairmen, village secretaries, ten cell leaders and farmers. The size of the group interview ranged from 10 to 15 people.

Secondary data on prices of various agricultural commodities were obtained from the various parastatal bodies involved in buying various crops. These were cross checked with the National price list published periodically and circulated in all district agricultural offices.

Prices on uncontrolled commodities were obtained from the farmers own records and compared with those of the market master's daily records at Kilosa and Morogoro markets for consistency. Other secondary data were collected from the District Agricultural Offices in Kilosa and Morogoro Regional Office, the University Library and some by personal communications with the Regional and District Development Officers. Data concerning the estimates on the cost of construction, improvement and maintenance of the two feeder roads were obtained from the Kilosa District Rural Development Office. The estimates available were for Myombo-Kidete feeder road and none were available for Rudewa-Nongwe feeder road for at the time of the data collection no survey had been carried out on Rudewa-Nongwe feeder road.

The field work was conducted during March-April, 1982. Interviews were held in private except group interviews which were conducted in the open.

3.2 Traffic flow

To get estimates on traffic flow data, an on the spot vehicle count was made at the junction of Kilosa-Mikumi main road on Myombo-Kidete feeder road, and at Lumuma village. An average estimate of 6 vehicles per week with the following axle load capacity was obtained.

Two seven (7) ton capacity vehicles
Three five (5) ton capacity vehicles
One two (2) ton capacity vehicles.

3.3 Technique of analysis

Economic appraisal and evaluation of road investment project using Road-users Benefits and Induced Benefits from agricultural production was carried out for Myombo-Kidete road. For Rudewa-Nongwe road only

Induced Benefits were used to appraise and evaluate the road improvement project.

Vehicle operating cost savings were obtained by taking the amount of crop produce to be ferried from each village for all the villages along the road on a round trip, multiplied by the cost savings made by vehicles with different axle load capacity on an improved/ gravel road, divided by the number of vehicles. The savings obtained were combined with induced agricultural benefits to calculate B/C ratio and IRR.

Induced agricultural benefits were obtained by taking the difference in crop yield (in money terms) of one year over the previous one. The yearly crop increase was estimated at 10 per cent (See Chapter V).

Traffic count along Myombo-Kidete road and vehicl operating costs savings recommended by the Transport and Road Research Laboratory TRRL appendices I and II were used to calculate Road-users Benefits.

The data obtained from the sample of farmers and that obtained from the National Milling Corporation N.M.C. were used to calculate the likely induced benefits along Myombo-Kidete road and Rudewa-Nongwe road areas. Comparison of the two feeder roads was made with the railway using induced benefits.

In calculating B/C ratio and Internal Rate of Return (IRR), induced Agricultural Benefits and Road-user's Benefits were used. The Road-user's benefits (vehicle operating cost savings) were obtained by comparing operating cost savings made by vehicles with different load axle weight being driven on a road improved from earth to gravel conditions. The life of the roads project taken for the purpose of calculating B/C ratio and IRR was estimated to be 10 years beginning 1983. The method of analysis for the two roads is given in Chapter V.

CHAPTER IV

SURVEY RESULTS

4.1 Farming systems

According to Norman (1978), a farming system is the result of a complex interaction among a number of independent components. To achieve it, an individual farmer allocates certain quantities and qualities of the four factors of production - land, labour, capital and management - to which he has access to the three processes - crops, livestock and off-farm enterprises, - in a manner which, within the knowledge he possesses, will maximize the attainment of the goal(s) he is striving for.

In this chapter results of the farming systems of the study area within the physical environment and potential resources available to the farmer are given. It examines the exogenous and endogenous factors helping or limiting the development of the area.

Population distribution: The sample farmer shown in Table 4.1 represents the number of households headed by the farmers. In terms of the numbers of villages surveyed, there are more households along the Central Railway than along the two feeder roads.

Table 4.1: Sample Villages: Population Distribution by sex

Village	Sample Farmer	Adults		Children			
	No. of families	Men	Women	Boys	Girls	Aged and disabled	Total
Myombo-Kidete Rd.							
Dodoma	367	360	397	429	394	15	1595
Chabima	140	100	130	150	130	3	513
Ibingu	151	136	149	111	110	15	521
Lumuma	601	440	502	353	423	11	1729
Total	1259	1036	1178	1043	1057	44	4358
Rudewa-Mongwe Rd.							
Unone	515	320	380	234	200	17	1151
Mtega	280	305	320	300	357	44	1326
Nongwe	250	220	219	373	357	16	1185
Mkobwe	251	347	353	300	300	20	1320
Masengo	353	350	360	600	740	50	2100
Total	1649	1542	1632	1807	1954	147	7082
Central Railway							
Munisagara	270	272	296	278	338	32	1211
Mzaganza	384	327	449	219	210	35	1240
Mwasa	269	260	289	288	297	3	1137
Kidete	474	371	408	375	420	21	1595
Total	1397	1230	1442	1155	1265	91	5183

Source: Sample Survey

In the same table, there are more females than males both adults and the children in most of the villages. There are but more disabled and aged along Rudewa-Nongwe road villages than along Myombo-Kidete road and the Central Railway.

In Table 4.2 the sample size is uniform except for Rudewa-Nongwe road. The marital status of the farmers appears polygamous in all the areas. There are more children below 10 years of age in both Myombo-Kidete and Rudewa-Nongwe roads than along the Central Railway. Children of working ability are few in all areas, and the family size is high in Nongwe and Myombo-Kidete areas. With relatively high labour force along Rudewa-Nongwe road area than elsewhere.

Labour availability: The labour available in mandays were obtained by treating all persons of 18 years and over as adult labour-equivalents. Children less than 18 years but above 16 years old and staying fully on the farm were treated as half an adult labour-equivalent. Children below 16 but above 10 years were treated as 1/4 an adult labour-equivalent. Children below 10 years of age and disabled and adults staying away from the farm or working elsewhere for salaried jobs were ignored as labour not available to the farm. Male and female

Table 4.2: Sample Farms: Sample size, number of wives, children, family size and labour force per family

	Sample size	Number of wives	Number of children: 10 yrs	Number of children: 10 18 yrs	Number of children: 16 18 yrs	Family size	Labour force
				Averages			
Myombo-Kidete Rd.	40	1.1	2.2	1.6	0.6	6.5	2.9
Rudewa-Mongwe Rd.	50	1.3	2.6	1.4	0.9	7.2	3.2
Central Railway	40	1.1	1.3	1.2	0.5	5.1	2.8

Source: Sample Survey

Table 4.3: Sample farms: Available farm labour by months

Month	Total days	Sundays	Public Holidays	Potential working days	Adult Equivalents available	Total Mandays
<u>Myombo-Kidete Rd.</u>						
January	31	5	2	24	2.9	69
February	28	4	1	23	2.9	66
March	31	4	0	27	2.9	83
April	30	4	3	21	2.9	61
May	31	5	1	25	2.9	72
June	30	4	0	26	2.9	75
July	31	4	2	25	2.9	72
August	31	5	0	26	2.9	75
September	30	4	1	25	2.9	72
October	31	5	0	26	2.9	75
November	30	4	0	26	2.9	75
December	31	4	3	24	2.9	69
<u>Rudewa-Nongwe Rd.</u>						
January	31	5	2	24	3.2	77
February	28	4	1	23	3.2	73
March	31	4	0	27	3.2	86
April	30	4	3	21	3.2	67
May	31	5	1	25	3.2	80
June	30	4	0	26	3.2	83
July	31	4	2	25	3.2	80
August	31	5	0	26	3.2	83
September	30	4	1	25	3.2	80
October	31	5	0	26	3.2	83
November	30	4	0	26	3.2	83
December	31	4	3	24	3.2	77

Table 4.3: (Continued)

Month	Total	Sundays	Public Holidays	Potential working days	Adult Equivalents available	Total Mandays
Central Railway						
January	31	5	2	24	2.8	67
February	28	4	1	23	2.8	64
March	31	4	0	27	2.8	75
April	30	4	3	21	2.8	59
May	31	5	1	25	2.8	70
June	30	4	0	26	2.8	73
July	31	4	2	25	2.8	70
August	31	5	0	26	2.8	73
September	30	4	1	25	2.8	70
October	31	5	0	26	2.8	73
November	30	4	0	26	2.8	73
December	31	4	3	24	2.8	67

Source: Computed from Table 4.2 last column adults equivalents and children equivalents were added to obtain average adult labour equivalents available to the farmer throughout the year. Total mandays were obtained by multiplying the last column of table by the number of potential working days in Table 4.3.

Accordingly there are more mandays available each month along Rudewa-Nongwe and Myombo-Kidete roads than along the Central Railway.

On the average a higher percentage of young farmers had attended formal school education (primary and secondary) and a higher percentage of old farmers had attended adult education. Also a higher percentage of old farmers had many years of farming experience Table 4.4.

Extension services and agricultural inputs

There was a high percentage of farmers who reported using agricultural inputs and receiving extension advice along Myombo-Kidete and Rudewa-Nongwe feeder roads. The smallest percentage of farmers reporting using agricultural inputs and receiving extension advice was along Rudewa-Nongwe road Table 4.5.

Table 4.4: Sampled farmers: Average age of the farmer, years of stay on village, farming experience and level of education (shown in percentage)

Area	Average age of farmer yrs	Farming Experience yrs	Length of stay on village yrs	Education in percentage			
				Secondary	Primary	Adult	Illiterate
Myombo-Kidete Rd.	42.0	22	20	27.5	30.0	37.5	5
Rudewa-Nongwe Rd.	40.1	19.5	30	26	42.0	30.0	2
Central Railway	45.5	26.5	28	15	27.5	57.5	0

Source: Sample Survey Maroh-April, 1982

Table 4.5: Sample farms: Use of extension advice and agricultural inputs, 1980/81 and 1981/82

Location	Farmers using fertilizer	Farmers using improved seeds	Farmers using insecticides	Farmers receiving extension advice
		Percent		
Myombo-Kidete Road	25.0	30	50	30
Rudewa-Nongwe Road	-	6	8	10
Central Railway	57.5	50	40	70

Source: Sample survey

4.2 Cropping calendar in Kilosa District

In an attempt to ensure a crop harvest, farmers in the Ukaguru and Rubeho mountain areas of Kilosa District have to time their crop activities to meet the rainfall periods.

In Table 4.6 it is shown that land preparation and planting activities are carried out from November to March. This is the period when maximum use of rains is made when rains begin in December, and continue to April and May. Crops which require longer periods of maturity are planted early in December and January, crops requiring shorter periods to mature i.e. beans and vegetables are planted in February and March. There is an overlaping of activities as the crops sown early in December and January begin being weeded when early maturity crops are being sown. And most of the crops both of late and early maturity are timed for harvest to occur in June up to August when rains have ceased. Part of August up to early November are slack periods when harvest is completed and next rains are being awaited.

Table 4.6: Kilosa District: Crop Calendar shown by crop activity

Crop	CROP ACTIVITY		
	Land preparation and planting	Weeding	Harvesting
Maize	November-January	January-February	May-June
Sorghum	November-January	February-March	July-August
Paddy	November-January	February-March	June-July
Wheat	February-March	-	July-August/Sept.
Beans	February-March	April-May	June-July
Vegetables	March-April	May-June	June-August
Potatoes	February-March	April-May	-
Cassava	January-February	-	-
Cotton	December-January	February-March	June-July

Source: Sample Survey March-April, 1982.

Table 4.7 shows the average number of hectares under crop cultivation and the percentage of farmers who reported growing the crop. As indicated in the table, maize and beans occupy a sizeable area of land and are grown by more farmers. Other crops grown on more land acreage and grown by more farmers are sorghum, wheat and paddy. All these are food crops, sweet potatoes, cassava and bananas were reported grown by more farmers though on small land area. The other crops which are grown by more farmers but relatively on small land are cowpeas, onions and cabbages. Cash crops such as cotton, coffee and sunflower are grown by fewer farmers and on small area.

Some crops are grown in one area and not available in the other i.e. yams, wheat, cotton, coffee, sunflower and cowpeas.

In Table 4,8 intercropping is shown to be more practiced in terms of land area along Rudewa-Nongwe feeder road than along Myombo-Kidete feeder road and the Central railway areas. Also the percentage of farmers who intercrop is more along the Rudewa-Nongwe feeder road area, though the same type of crops are intercropped in the three areas.

Table 4.7: Sample farms: Area under crop cultivation per family

Crop	Myombo-Kidete Road		Rudewa-Ncngwe Road		Central Railway	
	Area cultivated ha	Percentage of farmers growing	Area cultivated ha	Percentage of farmers growing	Area cultivated ha	Percentage of farmers growing
Maize	1.0	100	1.6	100	1.0	100
Sorghum	0.4	80	0.1	16	0.3	37.5
Paddy	0.1	12.5	0.1	40	0.2	35
Wheat	N.A.	-	0.4	38	N.A.	-
Beans	0.6	85	1.1	98	0.4	57.5
Cowpeas	0.2	42.5	0.1	12	-	-
Onions	0.2	22.5	0.1	20	0.3	50
Other vegetables	0.1	30	0.1	12	0.1	18
Yams	N.A.	-	0.1	18	N.A.	-
Sweet Potatoes	0.1	80	0.2	76	0.2	77.5
Cassava	0.2	97.5	0.1	48	0.2	75
Bananas	0.2	60	0.2	58	0.2	45.5
Cotton	0.4	45	N.A.	-	0.1	22.5
Coffee	N.A.	-	0.1	18	N.A.	-
Sunflower	0.1	12	N.A.	-	0.1	25
Total	3.5		4.3		3.1	

N.A. Not grown and data not available.

Source: Sample Survey

Table 4.8: Sampled farmers: Average hectares of land under intercropping and the percentage of farmers reporting intercropping by Roads/Railway

Crop	Myombo-Kidete Rd.		Rudewa-Nongwe Rd.		Central Railway	
	Area Inter-cropped ha	Percentage of farmers Inter-cropping	Area Inter-cropped ha	Percentage of farmers Inter-cropping	Area Inter cropped ha	Percentage of farmers Inter-cropping
Maize and Beans	0.4	52.5	1.0	84	0.4	68
Maize and Potatoes	0.2	17.5	-	-	0.2	50
Maize and Cassava	0.2	32.5	0.2	58	0.2	55
Total	0.8		1.2		0.8	

Source: Sample Survey, March-April, 1982.

Irrigation: Irrigation is practiced by farmers in villages along Lumuma and Mkondoa rivers. The crops grown under irrigation are rather few, and the average area under crop irrigation per farmer is relatively high along the Central railway than along Myombo-Kidete road as shown in Table 4.9.

Crop yields: Crop yields per hectare is highest for onions, and other vegetables and maize. Some crops are not grown in Nongwe area Table 4.10. The prices for the crops are uniform throughout the area.

Table 4.10.1 shows labour requirements in mandays per hectare for major crops. It indicates that most of the cash crops, cotton, coffee and onions and paddy take most of the farmers labour than food crops, unless the yields are high, farmers would not invest their labour into growing such crops.

4.3 Livestock husbandry

Livestock husbandry in the Ukaguru and Rubeho mountain areas of Kilosa District is hampered by the presence of tsetse fly. Large parts of the District especially the study area are covered by Miyombo woodland and grassland which form the natural homeland of tsetse fly.

Table 4.9: **Sample farms:** Crops under irrigation and area per farmer

Location	Crop Irrigated	Average area under crop ha	Percentage of Farmers practicing irrigation
Myombo-Kidete Road	Maize	0.4	35
Lumuma Village only	Onions	0.2	22.5
	Other vegetables	0.1	30.0
	Total	0.7	
Rudewa-Nongwe Road		N.A.	
Central Railway	Maize	0.6	65
	Onions	0.3	50
	Other vegetables	0.1	18
	Total	1.0	

N.A.: Not available (not practices)

Table 4.10: Sample farms: Mean crop yields tons/ha. and the value based on 1981/82 prices

Crop	Myombo-Kidete Road		Rudewa-Nongwe Road		Central Railway	
	Yield/ha (Tons)	Value T.Sh.	Yield/ha (Tons)	Value T.Sh.	Yield/ha (Tons)	Value T.Sh.
Maize	1.1	1855	1.1	1855	1.1	1855
Sorghum	0.8	1216	0.8	1216	0.8	1216
Paddy	0.9	2610	0.9	2610	0.9	2610
Beans	0.7	2506	0.7	2506	0.7	2506
Cowpeas	0.6	1425	N.A.	-	0.6	1425
Sunflower	0.6	977.50	N.A.	-	0.6	977.50
Cotton	0.9	3219	N.A.	-	0.9	3219
Onions	3.5	9396	3.5	9396	3.5	9396
Other vegetables	2.2	2104	2.2	2104	2.2	2104
Total	11.3	25308.50	9.2	19687	11.3	25308.50

N.A. : Crops not grown in the area

Source: Sample Survey

Table 4.10.1: Sample villages: Labour requirements for the major crops in the study area for the season 1981/82 in mandays

Crop Activity	Maize	Sorghum	Paddy	Wheat	Beans	Onions	Cotton	Coffee
Land Preparation	20	23	20	15	25	45	20	45
Planting	5	10	15	7	15	60	20	45
Weeding	25	36	40	0	20	58	46	30
Spraying	0	0	0	0	0	0	22	10
Harvesting	2	15	26	15	12	42	42	55
Selling	1	3	0	5	3	10	5	10
Others	0	2	4	3	3	15	0	0
Total	53	89	104	45	78	130	155	195

Source: Dragnostic survey

Table 4.11 shows the numbers of livestock kept in the study area. The commonly kept livestock are goats, sheep and poultry. And of these, the average number per farmer is high in Rudewa-Nongwe area than elsewhere. Cattle and donkeys are not kept in Myombo-Kidete and the Central railway area, except in Rudewa-Nongwe area.

4.4 Market performance

There is a substantial amount of crop produce sold by the farmers in the study area (Ukaguru and Rubeho mountain area).

Table 4.12 shows the amount of crops sold, average income per farmer from crop sales and percentage of farmers who sold. It can be seen that farmers along Rudewa-Nongwe feeder road area sold more varieties of crops though the average income per farmer is very low compared to farmers along Myombo-Kidete feeder road and those along the Central railway. Of the three areas, the Central railway farmers have more incomes from sale of crops than else where, seconded by the farmers along Myombo-Kidete feeder road.

Table 4.13 shows the average extra income from non farm activity. These include village teachers, and chiefs. As can be observed from individual villages,

Table 4.11: Sample farms: Livestock kept in average number of animals per farmer.

Animals/Birds	Number of Animals/ birds kept	Average number per family	Percentage of farmers keeping the animal/bird
Myombo-Kidete Rd.			
Cattle	N.A.	-	-
Donkeys	N.A.	-	-
Goats	89	2.2	30
Sheep	23	0.6	10
Poultry	518	13.0	85
Rudewa-Nongwe Rd.			
Cattle	123	2.5	26
Donkey	9	0.2	8
Goats	280	5.6	38
Sheep	89	1.8	26
Poultry	841	16.8	96
Central Railway			
Cattle	N.A.	-	-
Donkey	N.A.	-	-
Goats	216	5.4	30
Sheep	26	0.7	8
Poultry	292	7.3	80

N.A. : Not reared in the area

Source: Sample Survey

Table 4.12: Sampled farms: Amount of crop sales, average income per farmer, and percentage of farmers who reported having sold 1981/82

Crops	Amount harvest tons	Amount sold tons	Percentage farmers who sold**	Value T.Shs.
Myombo-Kidete Rd.				
Maize	8.8	2.3	81	4005.05
Beans	6.2	3.6	73	12708.50
Cowpeas	0.4	0.1	39	200.00
Sunflower	0.2	0.2	12	382.50
Cotton	4.9	4.9	45	17982.00
* Onions	71.8	71.8	22.5	193914.00
				229192.05
				** 5729.80
Rudewa-Nongwe Rd.				
Maize	6.2	2.1	14	3729.25
Beans	24.3	16.0	80	56028.00
Wheat	5.5	2.3	10	5757.50
Vegetables	4.7	4.7	12	4448.85
Potatoes	2.5	1.4	76	2160.00
Coffee	1.0	1.0	18	8910.00
* Onions	1.6	1.6	20	4050.00
				85083.60
				** 1701.65
Central Railway				
Maize	8.8	5.9	78	10349.50
Beans	6.8	3.4	51	11812.50
Bananas	6.7	6.7	37	6740.00
Sunflower	0.4	0.4	22.5	612.00
Cotton	0.9	0.9	37.5	3274.50
Onions	93.2	93.2	50.0	251640.00
				284428.50
				** 7110.50

* Onions are harvested twice a year.

** Income per capita from crop sales.

Source: Sample survey March-April, 1982.

Table 4.13: Sampled farms: Average extra income per farmer from non-farming activities by villages

Area	Amount per year T.Shs.	Percentage of farmers with extra
Myombo-Kidete Rd.		
Dodoma	20/-	10
Chabima	220/-	20
Ibingu	20/-	30
Lumuma	267/-	40
	707/-	
Rudewa-Nongwe Rd.		
Unone	238/-	40
Mtega	0	0
Nongwe	146/-	20
Mkobwe	56/-	10
Masenge	214/-	30
	654/-	
Central Railway		
Munisagara	77/-	10
Mzaganza	226/-	40
Mwasa	0	40
Kiidete	656/-	50
	959/-	

Source: Sample Survey, March-April, 1982.

those along the Central railway have more incomes from non farming activities than elsewhere. Also the farmer who reported having extra sources of income were more along the Central railway and perhaps along the Myombo-Kidete feeder road.

In Table 4.14 crop sales made to the National Milling Corporation NMC for the period 1978/79 - 1981/82, shows a steady increase over the years for beans along Myombo-Kidete road. There was a serious decline in maize sales along the Rudewa-Nongwe road over the years. However, there were no crop sales available for the villages along the Central railway over the period.

Table 4.15 shows the amount of estimated crop sales in the villages along the two feeder roads and the Central railway. In terms of the amount and the variety of crops estimated to be sold, villages along the Rudewa-Nongwe road would sell more than villages along the Central railway, and those along Myombo-Kidete feeder road. In addition Rudewa-Nongwe area has more of cash crops than other areas.

Table 4.16 shows the distance in kilometers from the villages to the market centre or town nearest. As can be observed from individual villages, those along Rudewa-Nongwe road have more distance to cover to reach

Table 4.14: Sample villages: Major crops sold to National Milling Corporation, NMC, 1978/79 - 1981/82

Location	Crop and year	Amount sold tons	Value T.Shs.
Myombo-Kidete Rd.			
	Beans		
	1978/79	57.9	202,650.00
	1979/80	55.1	192,850.00
	1980/81	59.0	206,500.00
	1981/82	123.9	433,650.00
Total		295.9	1,035,650.00
Annual crop increase = 5.6%			
Rudewa-Nongwe Rd.			
	Beans		
	1978/79	56.0	196,000.00
	1979/80	40.6	142,100.00
	1980/81	67.0	234,500.00
	1981/82	66.6	233,100.00
Total		230.2	805,700.00
Annual crop increase = 4.6%			
Central Railway		N.A.	
Myombo-Kidete Rd.	Maize		
	1978/79	49.6	42,160.00
	1979/80	77.1	77,100.00
	1980/81	87.6	87,600.00
	1981/82	100.6	176,050.00
Total		314.9	382,910.00
Annual crop increase = 4.2%			
Rudewa-Nongwe Rd.			
	1978/79	40.4	43,340.00
	1979/80	29.4	24,990.00
	1980/81	28.3	28,300.00
	1981/82	36.2	63,350.00
Total		134.3	159,980.00
Annual crop increase = 4.2%			
Central Railway:		N.A.	

N.A. : Data not available

Source : National Milling Corporation Crop purchases 1978/79 to 1981/82

Table 4.15: Sample villages: Estimated crop sales for the season 1982/83

Village	CROP					
	Maize (tons)	Beans (tons)	Wheat (tons)	Cotton (tons)	Coffee (tons)	Onions (tons)
Myombo-Kidete						
Lumuma	31.1	48.1	n.a.	n.a.	n.a.	143.6
Ibingu	40.8	31.7	n.a.	n.a.	n.a.	n.a.
Chabima	35.0	35.0	n.a.	13.1	n.a.	n.a.
Dodoma	127.0	70.0	n.a.	41.0	n.a.	n.a.
	233.9	184.8		54.1		143.6
Rudewa-Nongwe						
Unone	10.3	18.1	n.a.	-	n.a.	n.a.
Mtega	37.0	103.6	-	n.a.	-	n.a.
Nongwe	17.5	70.0	-	n.a.	-	n.a.
Mkobwe	62.8	47.8	10.6	n.a.	45.2	n.a.
Masenge	17.7	102.8	17.0	n.a.	31.8	n.a.
	145.3	342.3	27.6		77.0	
Central Railway						
Munisagara	21.6	34.6	n.a.	-	n.a.	-
Mzaganza	17.5	37.5	n.a.	-	n.a.	17.5
Mwasa	21.4	48.3	n.a.	-	n.a.	48.4
Kidete	75.7	46.0	n.a.	-	n.a.	-
	136.2	166.4				103.4

n.a. : The crop is not available in the area

Source : Sample Survey

Table 4.16: Sampled villages - Distance from villages to Market Centre (Km)

Village	Nearest Market Centre	Distance (Km)
Myombo-Kidete Rd.		
Lumuma	(Kilosa	70
	(Kidete to Kilosa rail)	24
Ibingu	Kilosa	63
Chabima	Kilosa	36
Dodoma	Kilosa	12
Rudewa-Nongwe Rd.		
Masenge	Kilosa	136
	Gairo	9
Mkobwe	Kilosa	122
Nongwe	Gairo	23
	Kilosa	109
Mtega	Gairo	36
	Kilosa	69
Unone	Kilosa	47
Central Railway		
Kidete	Kilosa	42
Mwasa	Kilosa	36
Mzaganza	Kilosa	24
Munisagara	Kilosa	16

Source: Sample Survey March-April, 1982.

Kilosa, except those near Gairo town. Villages along the Myombo-Kidete road also have relatively long distances to cover with exception of only Dodoma village near Kilosa. The Central railway villages get to Kilosa by train.

Mode of transport: The commonest mode of transport available in most villages is by head porterage and in some cases bicycles. Farmers along Rudewa-Nongwe road in addition to carrying on head, they in some cases use animals to transport their produce. Farmers along the Central railway with exception of those of Mwasa village commonly use train in addition to head porterage Table 4.17.

In Table 4.18 economic and social infrastructures are shown as against the population in the District and the study area. There are no hospitals and health centres available in the study area except dispensaries and first aid boxes in some isolated villages. Also no livestock health centres are available. Other infrastructures available in the study area are crop buying centres and primary schools. No secondary and Institutions are available at all in the study area.

Household items: The percentage of farmers owning bicycl radios and iron roofed houses is indicated in Table 4.19.

Table 4.17: Sample farms - Mode of transport to the Market/buying Centre

Village	Farmers using the mode				
	Head	Animals	Bicycles	Vehicles	Train
			Percent		
Myombo-Kidete Rd.					
Lumuma	60	N.A.	40	-	-
Ibingu	80	N.A.	20	-	N.A.
Chabima	80	N.A.	20	-	N.A.
Dodoma	70	N.A.	30	-	N.A.
Rudewa-Nongwe Rd.					
Unone	90	N.A.	10	-	N.A.
Mtega	100	N.A.	-	-	N.A.
Nongwe	80	20	-	-	N.A.
Mkobwe	70	30	-	-	N.A.
Masenge	70	30	-	-	N.A.
Central Railway					
Munisaga	20	N.A.	-	N.A.	80
Mzaganza	0	N.A.	-	N.A.	100
Mwasa	70	N.A.	30	N.A.	-
Kidete	0	N.A.	-	-	100

N.A. : Not available

\- : Cannot be computed

Source: Sample Survey

Table 4.18: Sampled villages - Infrastructures available in Kilosa District and the study area as against the population

Type of Infrastructure	Infrastructure available District	Infrastructure available along the Road/Railway		
		Myombo-Kidete	Rudewa-Nongwe	Central Railway
	Population 274,478	Population 4,356	Pop.7,082	Population 5,183
Hospitals	2	Nil	Nil	Nil
Rural Health Centres	4	Nil	Nil	Nil
Dispensaries	12	1	2	1
First Aid Boxes	33	1	1	3
Livestock Health Centres	4	Nil	Nil	Nil
Market/Crop buying Centres	78	1	1	1
<u>Schools/Institutions</u>				
Primary Schools	165	4	6	4
Secondary Schools	4	Nil	Nil	Nil
College of National Education	1	Nil	Nil	Nil
CCM College (Chama cha Mapinduzi College)	1	Nil	Nil	Nil
Folk Development College	1	Nil	Nil	Nil
<u>Administrative Centres</u>				
District Headquarters	1	Nil	Nil	Nil
Division Headquarters	9	1	1	1
Ward Headquarters	36	2	2	1

Source: Sample Survey, March-April, 1982

Table 4.19: Sample farms - Household items owned

	Item	Number	Proportion of farmers owing
			Percent
Myombo-Kidete Rd.			
	Bicycle	11	27.5
	Radio	17	42.5
	Iron Roof house	2	5.0
Rudewa-Nongwe Rd.			
	Bicycle	9	18.0
	Radio	20	40.0
	Iron Roof house	9	18.0
Central Railway			
	Bicycle	9	22.5
	Radio	15	37.5
	Iron Roof house	9	22.5

Source: Sample Survey

The number of farmers owning iron roofed houses is very low compared to that owning the other items especially along the Myombo-Kidete road.

Table 4.20 shows the cost estimates of improving Myombo-Kidete feeder road. The costs are broken into fixed and variable costs. Fixed costs being costs of building materials, and permanent labour. Variable costs are transport and fuel costs and miscellaneous costs. Also maintenance costs are shown.

Table 4.21 shows the official producer prices payable for selected food and export crops. All the crops are price controlled except onions. In which case their increased production cannot change the prices. And sometimes low prices are disincentive to farmers.

Table 4.22 shows the average classified weekly traffic on Myombo-Kidete road. The traffic is too small to effect any significant economic development. But since it is in the subsistence type of economy it will be considered in the road analysis.

Table 4.20: Kilosa District - Estimates of improving Myombo-Kidete Road

Fixed costs	T. Shs
Cost of building material (bridges and culverts)	111,430.70
Cost of steel	202,690.20
Sand, stones and concretes	85,417.50
Cement	195,932.40
Labour (permanent)	245,796.80
Sub-Total	841,267.60
<u>Variable costs</u>	
Transport and fuel	107,354.45
Miscellaneous	2,591.40
Sub-Total	109,945.85
Total cost (estimates)	951,213.00
Maintenance cost	47,560.00

Source: Kilosa District Development 4th Five Year Plan 1981/82 - 1985/86

Table 4.21: Official Producer Prices Payable for Selected Food Crops 1972/73 - 1982/83 (cents per kg)

	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83
Maize	26	33	50	75/80	80	85	85	100	100	150(1)	175(2)
Paddy	56	57	65	100	100	120	120	150	175	230(1)	300(3)
Wheat	57	57	77	100	120	125	125	135	165	220(1)	300
Cassava -											
- M'opa	-	31	36	40	50	60	65	65	65	70	90(4)
- Udanga	-	29	34	38	40	50	50	50	50	50	70(4)
Finger Millet	-	-	55	80/85	95	200	200	200	150	150	150
Sorghum/ Bulrush Millet	30	50	55	75	90	100	100	100	100	100	160(5)
Groundnuts	115	115	150	200	250	400	400	400	420	480	580
Sunflower											
- Black	57	55	75	100	110	150	170	170	160	200	290
- Jupiter	57	55	75	100	110	150	150	150	160	180	260
- Other	-	35	70	75	80	125	130	140	150	170	250
Simsim	120	160	200	200	250	300	330	350	400	450	570
Grapes	250	250	250	250	350	350	350	400	400	500	600
Copra	-	-	-	135-220	210-230	220-250	230	230	250	300	420
Beans - I	-	-	-	-	200	200-350	350	350	350	350	350
- II	-	-	-	-	175	175-275	275	275	275	275	275
Soyabeans	-	-	-	-	225	225	225	225	225	225	300
Onions	-	-	-	-	-	-	-	-	-	-	270

Notes: (1) Prices include deficit season price adjustment of 30 c/kg
(2) Reduced price of 150c/kg to apply in Mwanza Region, Shinyanga Region (except Kahama District), Singida Region, Mara Region (except Tarime District), Dodoma District, Mtwara and Lindi
(3) Applicable in Morogoro, Coast, Tanga, Kigoma, Tabora, Mbeya and Shinyanga Regions - in other Regions paddy price is Sh. 250c/ka
(4) Applicable in Mtwara, Lindi, Mwanza, Shinyanga, Mara, Coast and Tabora Regions-in other regions Grade I cassava price: 70c/kg and Grade II 50c/kg
(5) Applicable in Mwanza, Mara, Shinyanga, Singida, Tabora, Dodoma Regions and Same and Mwanga Districts of Kilimanjaro Region.

Source: Marketing Development Bureau, Ministry of Agriculture. July 1981.

Table 4.21 (Cont'd): Official Producer Prices Payable for Selected export crop 1972/73 to 1982/83 (cents/kg)

	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83
Coffee - (1)											
Arabica											
Parchment I											
- advance	-	-	-	-	600	900	800	800	900	900	900
- total	-	-	-	-	1,500	1,089	907	n/a	n/a	n/a	n/a
Robusta Dry											
Cherry											
- advance	-	-	-	-	330	490	375	375	350	475	n/a
- total	-	-	-	-	885	527	464	n/a	n/a	n/a	n/a
Cotton - AR	113	113	150	200	200	230	240	300	320	370	470
- BR	60	60	65	100	100	115	120	130	150	170	250
Cashewnuts - SG	95	95	105	105	110	115	170	180	300	500	n/a
- UG	75	75	95	95	95	100	140	150	200	350	n/a
Tobacco - Flue	585	585	585	700	740	740	740	880	1,050	1,260	1,800(2)
- Fire	213	240	255	300	450	520	520	625	625	770	1,150(2)
- Burley	-	-	-	-	480	480	480	650	650	680	1,000
Tea (Green Leaf) (3)	71	74	74	80	90	150	150	150	150	150	150
Pyrethrum											
- Gr. I	-	-		650	650	650	650	750	1,100	1,320	1,320
- Gr. II	-	-	421	550	550	550	600	700	950	1,200	1,200
- Gr. III	-	-		421	421	421	500	650	850	1,000	1,100
- Gr. IV	-	-		400	400	400	460	600	750	1,000	1,000
- Gr. V	-	-	-	-	-	-	-	550	650	900	900
Cardamoms - I	-	2,400	2,400	2,800	3,000	5,000	5,500	5,500	6,000	8,000	8,000
- II	-	2,000	2,100	2,100	2,100	3,500	5,500	5,000	5,000	5,000	7,000
-III	-	1,700	1,800	1,200	1,500	2,500	4,500	4,500	4,500	4,500	4,500
Castorseed	-	55	55	70	75	100	100	100	120	170	170

Notes: (1) Before 1976/77 prices were determined by individual Producer Cooperative Union
(2) Including average estimated value of 400c/kg quality bonus applicable to flue-cured and 300c/kg quality bonus applicable to fire-cured
(3) All prices include the credit repayment amount; prior to 1976/77 the price shown is the weighted average for the four main small holder tea factories

Source: Marketing Development Bureau, Ministry of Agriculture. July 1981.

Table 4.22: Average weekly classified traffic (AWT) Myombo-Kidete road (1982)

Section	Passenger cars	Light vans	Medium trucks	Total
Lumuma	0	2	1	3
Kilosa-Mikumi and Myombo-Kidete Junction	1	1	1	3

Source: Traffic count during survey 1982.

4.5 Farming systems review

The farming system along the Rudewa-Nongwe road, differ slightly from those along Myombo-Kidete road and the Central Railway areas. The difference stems from population density, land potential, accessibility to agricultural inputs and extension services and market facilities.

Population distribution: The population distribution and labour force availability is higher along Rudewa-Nongwe road than along Myombo-Kidete road and the Central Railway areas. The average family labour force which determines the amount of farm activity and farm area is 3.2 persons of adult labour equivalent along Rudewa-Nongwe road area whereas it is 2.9 and 2.8 persons of adult labour equivalent along Myombo-Kidete road and the Central Railway respectively, Tables 4.1 and 4.2.

Land potential: The amount of crops grown in Rudewa-Nongwe road area indicate high land potential. Coffee and wheat, in addition to the main crops grown in the area, require more reliable rainfall. Cotton and sun-flower grown along Myombo-Kidete road and the Central Railway areas favour less rainfall. In which case, Rudewa-Nongwe road area has more land potential than the rest of the other two areas. Also the average area under crop cultivation is higher, 4.3 ha. along Rudewa-Nongwe road compared to 3.5 and 3.1 ha. along Myombo-Kidete road and the Central Railway respectively, Table 4.7. In addition, Rudewa-Nongwe road area has potential for livestock especially cattle and donkey which are not available along Myombo-Kidete and the Central Railway areas, Table 4.11. Thus Rudewa-Nongwe road has more cash crop and animal potential resources than Myombo-Kidete road and the Central Railway areas.

Accessibility to infrastructures: Although the Rudewa-Nongwe road area has good land potentials, and manpower, it has a disadvantage in respect to accessibility to infrastructures, which determine the amount of economic progress an area has. There are more farmers who use agricultural inputs and who receive extension advice along the Central Railway and Myombo-Kidete road than along Rudewa-Nongwe road areas, Table 4.5. The number of farmers who receive and perhaps use the inputs indicates the change in the farming systems in the area. Also the farmers along the Central Railway and Myombo-Kidete road areas practice irrigation, which though not fully technical indicates some amount extension advice received in the area. All farmers in Rudewa-Nongwe road area grow crops under natural conditions, whereas the farmers along Myombo-Kidete and the Central Railway are capable of mechanising, hence change the subsistence farming systems to modern. The crops grown under irrigation: maize, onions and other vegetables Table 4.9 are partly food and partly cash crops especially maize. Crops growing under irrigation, if canals are properly designed and water can be regulated can be grown throughout the year. In this case, farmers along the Central Railway and the Myombo-Kidete road are capable of maximizing crop yields hence get more food supply throughout the year than farmers growing crops under natural conditions.

Market facilities:

Farmers along Myombo-Kidete road and the Central Railway are nearer to transport and marketing facilities than the farmers along Rudewa-Nongwe road. Farmers along the Central Railway and Myombo-Kidete road sell more crops hence receive more cash incomes than farmers along Rudewa-Nongwe road, Table 4.12. With more incomes, farmers are capable of modernizing their farming practices and this would be the case for the farmers along the Central Railway and Myombo-Kidete road areas.

In all if the area was accessible all the year round, farmers along Rudewa-Nongwe road would practice more modern farming systems than the farmers along the Central Railway and along Myombo-Kidete road because of land potential in the area.

CHAPTER V

ANALYSIS

5.1 Data requirement

In Chapter four farming systems along Myombo-Kidete, Rudewa-Nongwe roads and the Central Railway are presented. This chapter sets out to analyse road-users' benefits and induced agricultural benefits using some of the data in Chapter 4. The analysis is made under the following headings.

Myombo-Kidete road: Analysis of the road-users' benefits and induced agricultural benefits is carried out to calculate benefit-cost (B-C) ratio and internal rate of return IRR.

Rudewa-Nongwe road: The analysis of induced agricultural benefits is made to calculate B-C ratio and IRR.

Central Railway: Incomes obtained from the sale of crops along the Central Railway are compared with the incomes obtained from the sale of similar crops along the two roads.

5.2 Measures employed

For the purpose of this study two measures of economic viability have been adopted from Haveman (1970) Gittinger (1972) and Haim Levy and Marshall Sarnat (1978). These are:

- Benefit-Cost (B-C) ratio
- Internal rate of return IRR

(i) Benefit-Cost ratio: Benefit-cost ratio has been defined as the ratio of the value of the benefits of a programme to the value of the programme's costs (Haveman, 1970 and Gittinger, 1972). Clearly when the ratio is greater than one, the public expenditures for the project are judged to be economically worthwhile. If the ratio is equal to one, the public expenditure adds nothing to the balance of the national economy, if it is less than one, it detracts from the economic well being.

$$\text{B-C ratio} = \frac{\sum_{t=0}^{T} B_t \; (1+r)^t}{\sum_{t=0}^{T} C_t \; (1+r)^t}$$

Where Bt = benefits earned in time t

Ct = costs incurred in time t

r = discount factor of 1.0

T = life of the project 10 years

t = 0 to 10

(ii) Internal rate of return IRR: The internal rate of return IRR is a time-discounted measure of investment worth. It is known as "marginal efficiency of capital", "discounted cash flow", "investor's method" etc. The internal rate of return IRR is defined as that rate of discount which equates the present value of the stream of net receipts with the initial investment outlay (Haim Levy and Marshall Sarnat, 1978).

i.e. R such that $$Io = \sum_{i=1}^{n} \frac{Si}{(1+R)^i}$$

Where Io = initial investment

Si = net cash flow in year i

$R = \frac{I}{100}$, I = interest rate

An alternative and equivalent definition of IRR is "that rate of discount which equates the net present value NPV of the cashflow to zero".

$$NPV = \sum_{i=0}^{n} \frac{Si}{(1+R)i} = 0$$

For the purpose of calculating the net cashflows (Si), two types of economic benefits were taken into account:

- road-users' benefits
- induced agricultural benefits

5.3 Road-users benefits: Road-user costs were based on National Milling Corporation's (N.M.C.) current cost of Shs. 2/50 per ton-Km. It was difficult to estimate the saving expected from the road improvements. However, it is anticipated that the improved roads and higher volumes of sales will lead to a substantially improved difference of operation of crop procurement vehicles, particularly since the local co-operatives are about to be reorganised and therefore transport is likely to be used more flexibly for carrying inputs and other materials into the villages as well as for carrying purchased crops. It is therefore considered that a reduction of 50% in the ton-Km cost to 1/25 per ton-Km will not be an unreasonable estimate of the costs.

In the analysis road-user benefits were combined with induced agricultural benefits because it was difficult to separate out the transport savings for existing sales from the costs of the induced increase in crop sales.

Table 5.1 shows the road-user savings calculated using crop volume transported on unimproved and improved roads.

5.4 Calculation of induced agricultural benefits

Induced agricultural benefits are the most important benefits and indeed, the main reason for feeder roads construction. In developing countries such as Tanzania, it is generally believed that construction of feeder roads will assist in increasing agricultural produce by allowing easier transport both of the produce itself and of important inputs - fertilizers, insecticides, improved seeds, etc. Moreover, the improvement of feeder roads increase accessibility for government agents, particularly extension workers, whose advice will also lead to increased production. As the World Bank puts it: ".... the problem of assessing feeder roads is essentially one of measuring the response of output to changes in transport costs along with and relative to all other inputs such as land clearance, settlement, storage and marketing facilities, etc." (World Bank, 1972).

In order to calculate induced agricultural benefits the following are necessary:

1. Firstly, crop yields per hectare must be known for different crops. The yields per hectare can be used to calculate the incomes obtained by the farmer(s) after deducting all marketing margins, transport and labour costs from market prices for the crop produce. Data required for this was obtained from the survey results as shown in Table 4.10.

2. Labour requirements per ton or per hectare for different crops must also be known or estimated. The data on labour requirements was used to calculate the amount of farmers' labour spent on the crop production so as to determine their profitability. The data on labour requirements was obtained from the estimates on labour in mandays per hectare shown in Table 4.10.1.

3. The amount of crop to be collected from each village must be known. Data on crop volume was used to estimate the number of vehicle trips on the road collecting the produce from the villages to the

Table 5.1: Myombo-Kidete road: Road-users' benefits

Item	Present road	Improved road	Savings Shs
Average operating costs[1] (Shs/ton Km)	2.50	1.25	1.25
Total ton.Km of crops presently marketed[2] (ton.Km)	44,625	44,625	44,625
Total	111,562	55,781	55,781

1 Estimated from current National Milling Corporation NMC operating costs.

2 Estimated from crop sales (See Table 4.15) multiplied by the Km for the round trip from Kilosa necessary to collect these sales from the villages.

market centre. The number of vehicle trips made on unimproved and improved road determine the amount of vehicle operating cost savings used to calculate road-users' benefits. Data required was obtained from the estimated crop sales from various villages along the two roads and the railway (Table 4.15).

4. Prices of various crops sold must be known. The data obtained were used to estimate crop profitability which determine farmers incomes. Data was obtained from the price list of the Ministry of Agriculture for 1972/73 to 1982/83 period (Table 4.21).

5. Existing wage rate per manday together with transport costs per ton.Km must be known or estimated. The village existing wage of Shs 25/- was used to calculate labour costs per manday. Finally, percentage increase in crop sales for marketed crops must be known or estimated[1]. A 10% increase was adopted for this purpose.

Note[1]: It is difficult to know what the effect of the improved roads on the annual growth in crop sales would be. Hopefully, a substantial increase would result.

At present, the annual growth in crop sales is running at about 5%. For the purposes of analysis a rather pessimistic view of the effect of the road improvements on crop sales was taken: a figure of 10% was chosen as being twice the present 5% growth rate. However, a substantially higher figure would be expected if other necessary factors particularly extension workers and crop inputs are also provided. Thus the figure of 10% is taken as a baseline figure, if the projects are viable at this level, then they would certainly be very viable if higher rates of growth are derived. Conversely, if the projects are not viable with this assumption then a close look at the other factors involved should be taken before committing any fiance to the projects.

5.5 Induced agricultural benefits along the Myombo-Kidete road

Tables 5.2 to 5.5 show estimated economic benefits from induced agricultural production from each of the four villages along the Myombo-Kidete road.

It can be observed from the respective tables that high marketing margin and high transport costs on unimproved road affect the net prices farmers receive after deducting these costs. Also low prices paid for most of the crops e.g. maize, beans and cotton do affect farmers' net income. In most cases farmers are left with losses after deducting marketing margin, transport costs and labour costs e.g. the farmer has a loss of (Shs 48/-) from maize, (Shs 110/-) from beans, Table 5.2, (Shs 13/-) from maize, (Shs 75/-) from beans, Table 5.3 and (Shs 45/-) from cotton, Table 5.4.

This implies that the farmer(s) will only produce the crop for the family consumption and not for sale. In most cases a crop such as cotton is grown because of law but not according to the farmers' wishes.

However, after road improvement, low marketing margins and low transport costs act as incentives for farmers to produce. Even if prices of most of the crops remain low, still farmers will realise enough incomes from the crop sales.

In Table 5.6 a summary of net economic benefits from the four villages along Myombo-Kidete road is given. The net benefits of Shs 374,034/- is used to calculate annual cash flows at 10% annual increase for ten years as shown in Table 5.7, together with road-users' benefits shown in Table 5.1.

5.6 Benefit CostB/C ratio and Internal rate of return IRR for Myombo-Kidete road

Table 5.7 shows the economic benefits associated with the improvement of Myombo-Kidete road. The annual cashflows from road-users' and induced agricultural benefits are discounted in order to calculate the Benefit Cost B/C ratio and Internal rate of return IRR.

The B/C ratio of 3.1 and IRR of 49% clearly imply that the project is economically viable and worth the investment. The implication of this is that there is already some degree of market economy being practised in the area. However, caution must be taken with both B/C ratio and the IRR.

When considering B/C ratio the following should be observed:

(a) A large propertion of the benefits for an improved feeder road is expected to come from the generation of more traffic which did not exist before, that is, the benefit is from induced development rather than cost reduction of existing traffic. Table 5.1 shows the savings from the existing traffic on Myombe-Kidete road and not from induced development. Therefore B/C ratio and IRR on traffic volume fall short of reality since it is hard to predict how much traffic will be attracted by the road improvement.

Table 5.2: Economic returns from crop sales along Myombo-Kidete road (Lumuma village)

	Maize			Beans			Onions			
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Total Difference
Price (Shs/ton)	1750	1750		3500	3500		2700	2700		
Marketing margin[1]	263	131		525	262		405	202		
Net price (Shs/ton)	1487	1619		2975	3238		2295	2498		
Labour (Mandays/ton)	48	48		110	110		70	70		
Labour costs @ Shs 25/-	1200	1200		2750	2700		1750	1750		
Net price (Shs/ton)	287	419		225	488		545	748		
Transport costs[2] (Shs/ton)	335	175		335	175		335	175		
Net price (Shs/ton)	(48)	244		(110)	313		210	570		
Sales (tons/year)	30.1	33.1	3	48.1	52.9	4.8	143.6	158		
Total economic returns[3] (Shs/year)	(1445)	8076	9521	(5291)	16558	21849	30156	90060	120216	151,586
Annual increase in economic returns[4] (Shs/year)			732		1502				8208	10.442

Source: Computed from Tables 4.15 and 4.16

Notes :
1) 15% before road improvement, 7½ after road improvement (see text)
2) Before improvement: 128 Km @ 2/50 + 12 Km @ 1/25 = 335/- per ton
3) Costs of inputs were not taken into account as the farmers are presently using negligible amounts of purchased inputs
4) 10% increase in net revenue per year

Table 5.3: Economic returns from crop sales along Myombo-Kidete road (Ibingu village)

	Maize			Beans			
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Total Difference T.Shs
Price (Shs/ton)	1750	1750		3500	3500		
Less marketing margin[1]	263	131		525	262		
Net price (Shs/ton)	1487	1619		2975	3238		
Labour (Mandays/ton)	48	48		110	110		
Less labour costs @ Shs 25/-	1200	1200		2750	2750		
Net price (Shs/ton)	287	419		225	488		
Transport costs[2] (Shs/ton.Km)	300	158		300	158		
Net price (Shs/ton)	(13)	261		(75)	330		
Sales (tons/year)	40.8	44.9	4.1	31.7	34.9	3.2	
Total economic returns[3] (Shs/year)	(530)	11719	12249	2378	11517	13896	26145
Annual increase in economic returns[4] (Shs/year)			1070			1056	2126

Notes: 1) 15% before road improvement, $7\frac{1}{2}$ after road improvement (see text)
2) Before road improvement, 114 Km @ 2/50 + 12 Km @ = 300/- per ton
3) as in Table 5.2
4) as in Table 5.2

Source: Computed from Table 4.15 and 4.16

Table 5.4: Economic returns from crop sales along Myombo-Kidete road (Chabima village)

	Maize			Beans			Cotton			
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Total Difference
Price (Shs/ton)	1750	1750		3500	3500		4700	4700		
Marketing margin[1]	263	131		525	262		705	353		
Net price (Shs/ton)	1487	1619		2975	3238		3995	4347		
Labour (Mandays/ton)	48	48		110	110		155	155		
Labour cost @ Shs 25/-	1200	1200		2750	2750		3875	3875		
Net price (Shs/ton)	287	419		225	488		120	472		
Transport costs[2] (Shs/ton)	165	90		165	90		165	90		
Net price (Shs/ton)	122	329		60	398		(45)	382		
Sales (tons/year)	35	38.5	3.5	35	38.5	3.5	13.1	14.4	1.3	
Total economic returns[3]	4270	12667	16937	2100	15323	17423	(590)	5501	6091	40,451
Annual increase in economic returns[4]			1152			1393			497	3,042

Source: Computed from Tables 4.15 and 4.16

Notes : 1) as in Table 5.2
2) before improvement, 60 Km @ 2/50 + 12 Km at 1/25 = 165/-
3) as in Table 5.2
4) as in Table 5.2

Table 5.5: Economic returns from crop sales along Myombo-Kidete road (Dodoma village)

	Maize			Beans			Cotton			
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Total Difference
Price (Shs/ton)	1750	1750		3500	3500		4700	4700		
Marketing margin[1]	263	131		525	262		705	353		
Net price (Shs/ton)	1487	1619		2975	3238		4696			
Labour (Mandays/ton)	48	48		110	110		155	133		
Labour cost C Shs 25/-	1200	1200		2750	2750		3875	3875		
Net price (Shs/ton)	287	419		225	488		120	472		
Transport costs[2]	45	30		45	30		45	30		
Net price (Shs/ton)	242	389		180	458		75	442		
Sales (ton/year)	127	139.7	12.7	70	77	7	41	45.1	4.1	
Total economic returns[3] (Shs/year)	30734	54243	84977	12600	35266	47866	3075	19934	23009	155,852
Annual increase in economic returns[4]			4940			3206			1812	9,958

Source: Computed from Tables 4.15 and 4.16

Notes : 1) as in Table 5.2
2) before improvement, 12 Km @ 2/50 + 12 Km @ 1/25 = 45/-
3) as in Table 5.2
4) as in Table 5.2

Table 5.6: Summary of Net Economic Benefits along Myombo-Kidete road

Village	Source of data	Net Benefits T.Shs	Net increase
Lumuma	Table 5.2	151,586	10,442
Ibingu	Table 5.3	26,145	2,126
Chabima	Table 5.4	40,451	3,042
Dodoma	Table 5.5	155,852	9,958
Total Net Benefits		374,034	25,568

Table 5.7: Economic benefits associated with road improvement (Myombo-Kidete Road)

Year	0	1	2	3	4	5	6	7	8	9	10
<u>Benefits</u>:		429815	472797	520077	572085	629294	692223	761445	837590	921349	1013484
<u>Costs</u>:											
Initial capital[1]	951213										
Maintenance costs[2]	-	47560	47560	47560	47560	47560	47560	47550	47560	47560	47560
Yearly net benefits	(951213)	382255	425237	472517	524525	581734	644663	713885	790030	873789	965924

Benefit Cost B/C ratio = 3.1

International rate of return IRR = 49% approx.

Source: Computed from Tables 4.20, 5.1 and 5.6

Notes : 1) Initial capital at the beginning of the project invested in year zero

2) Maintenance costs incurred yearly beginning with year one of the project

5.7 Induced Agricultural Benefits/Rudewa-Nongwe road

In Tables 5.8 to 5.12 estimated economic benefits from induced agricultural production from each of the five villages along the Rudewa-Nongwe road is shown.

Marketing margins and transport costs charged on crop sales transported on unimproved road reduce farmers' net income to the lowest margin. In the same way low prices paid for most crops e.g. maize and beans hinder the production of such crops for sale. Farmer(s) receive very little margin after deducting all the marketing margins, transport and labour costs. This implies that farmers grow the crops only for food and not for cash, especially farmers in villages far away from the market centres, e.g. Mtega Table 5.9.

It is only after road improvement that such low priced crops become economical to produce. This means that improved roads are incentive to attract production. Crops which have high prices are produced in large quantity even on unimproved road. Hence the production will be stepped up if the road is improved. Cash crops such as wheat and coffee shown in Tables 5.11 and 5.12 will be grown at a higher rate than they are grown at present. This means that high prices for such crops as wheat and coffee induce farmers to produce more crops than they do with low prices for such crops.

Table 5.13 shows a summary of economic benefits along Rudewa-Nongwe road. The net benefits of Shs 1,048,179 are used to estimate the annual cashflows at 10% annual increase for the 10 year period of the life time of the road.

5.8 Benefit Cost ratio B/C and IRR for Rudewa-Nongwe road

5.8.1 Road-users' benefits: There was no traffic existing along Rudewa-Nongwe road from which to take traffic count, hence road-users' benefits were not taken into account in the evaluation of the project.

5.8.2 Induced agricultural benefits: Annual cashflows accruing to the farmers from induced crop production are shown in Table 5.14. The discounted cashflows show a a Benefit Cost B/C ratio and internal rate of return IRR are shown in the same table. The B/C ratio of 5 and IRR of 50% imply that from the efficiency economic standard point the project is highly viable.

Table 5.8: Economic returns from crop sales along Rudewa-Nongwe road (Unone village)

	Maize			Beans			
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Total Difference T.Shs
Price (Shs/ton)	1750	1750		3500	3500		
Marketing margin[1] (Shs/ton)	263	131		525	262		
Net price (Shs/ton)	1487	1619		2975	3238		
Labour (Mandays/ton)	48	48		110	110		
Labour costs at Shs 25/-	1200	1200		2750	2750		
Net price (Shs/ton)	287	419		225	488		
Transport costs [2] (Shs/ton)	185	113		185	113		
Net price (Shs/ton)	102	306		40	375		
Sales (tons/year)	10.3	11.3	1	18.1	19.9	1.8	
Total economic returns[3] (Shs/year)	1051	3458	4,409	724	7463	8187	13,096
Annual increase in economic returns[4] (Shs/year)			306			675	981

Source: Computed from Tables 4.10, 4.10.1, 4.15 and 4.16

Notes:
1) 15% before road improvement, 7½ after road improvement (see text)
2) Before improvement: 54 Km @ 2/50 + 40 Km @ 1/25 = 185/- per ton
3) Cost of inputs were not taken into account as the farmers are presently using negligible amount of purchased inputs.
4) 10% increase in net revenue per year.

Table 5.9: Economic returns from crop sales along Rudewa-Nongwe road (Mtega village)

	Maize			Beans			
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Total Difference T.Shs
Price (Shs/ton)	1750	1750		3500	3500		
Marketing margin[1]	263	131		525	262		
Net price (Shs/ton)	1487	1619		2975	3238		
Labour (Mandays/ton)	48	48		110	110		
Labour costs @ Shs 25/-	1200	1200		2750	2750		
Net price (Shs/ton)	287	419		225	488		
Transport costs[2] (Shs/ton)	295	173		295	173		
Net price (Shs/ton)	(8)	246		(70)	315		
Sales (tons/year)	37	40.7	3.7	103.6	114	10.4	
Total economic returns[3] (Shs/year)	(296)	10012	10308	(7252)	35910	43,162	53,470
Annual increase in economic returns[4] (Shs/year)			910			3,276	4,186

Source: Computed from Tables 4.10, 4.10.1, 4.15 and 4.16

Notes:
1) as in Table 5.8
2) before road improvement: 98 Km @ 2/50 + 40 Km @ 1/25 = 295/- per ton
3) as in Table 5.8
4) as in Table 5.8

Table 5.10: Economic returns from crop sales along Rudewa-Nongwe road (Nongwe village)

	Maize			Beans			
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Total Difference T.Shs
Price (Shs/ton)	1750	1750		3500	3500		
Marketing margin[1] (Shs/ton)	263	131		525	262		
Net price (Shs/ton)	1487	1619		2975	3238		
Labour (Mandays/ton)	48	48		110	110		
Labour costs @ 25/-	1200	1200		2750	2750		
Net price	287	419		225	488		
Transport costs[2] (Shs/ton)	180	90		180	90		
Net price (Shs/ton)	107	329		45	398		
Sales (ton/year)	17.5	19.3	1.8	70	77	7	
Total economic returns[3] (Shs/year)	1873	6350	8223	3150	30646	33796	42,019
Annual increase in economic returns[4] (Shs/year)			592			2786	3,378

Source: Computed from Tables 4.10, 4.10.1, 4.15 and 4.16

Notes:
1) as in Table 4.8
2) before road improvement: 72 Km @ 2/50 = 180/- per ton
3) as in Table 5.8
4) as in Table 5.8

Table 5.11: Economic returns from crop sales along Rudewa-Nongwe road (Mkobwe village)

	Maize			Wheat			Beans		
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Present	After road Improvement	Dif: enc
Price (Sh/ton)	1750	1750		3000	3000		3500	3500	
Marketing margin[1] (Sh/ton)	263	131		450	225		525	262	
Net price (Sh/ton)	1487	1619		2550	2775		2975	3238	
Labour (Mondays)	48	48		56	56		110	110	
Labour cost @ 25/-	1200	1200		1400	1400		2750	2750	
Net price (Sh/ton)	287	419		1150	1575		225	488	
Transport costs[2] (Sh/ton)	115	58		115	58		115	58	
Net price (Sh/ton)	172	361		1035	1517		110	430	
Sales (tons/year)	62.8	69.1	6.3	10.6	11.7	1.1	47.8	52.6	
Total economic returns[3]	10802	24945	35747	10971	17749	28,720	5258	22618	2
Annual increase in economic returns[4]			2274.			1,689			

Source: Computed from Tables 4.10, 4.10.1, 4.15 and 4.16

Notes : 1) as in Table 5.8
2) before road improvement: 46 Km @ 2/50 = 115/- per ton
3) as in Table 5.8
4) as in Table 5.8

Table 5.11: Economic returns from crop sales along Rudewa-Nongwe road (Mkobwe village)

	Maize			Wheat			Beans			Coffee		
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Present	After road Improvement	Dif[illegible] enc[illegible]
Price (Sh/ton)	1750	1750		3000	3000		3500	3500		9000	9000	
Marketing margin[1] (Sh/ton)	263	131		450	225		525	262		1350	675	
Net price (Sh/ton)	1487	1619		2550	2775		2975	3238		7650	8325	
Labour (Mondays)	48	48		56	56		110	110		108	108	
Labour cost @ 25/-	1200	1200		1400	1400		2750	2750		2700	2700	
Net price (Sh/ton)	287	419		1150	1575		225	488		4950	5625	
Transport costs[2] (Sh/ton)	115	58		115	58		115	58		115	58	
Net price (Sh/ton)	172	361		1035	1517		110	430		4835	5567	
Sales (tons/year)	62.8	69.1	6.3	10.6	11.7	1.1	47.8	52.6	4.8	45.2	49.7	
Total economic returns[3]	10802	24945	35747	10971	17749	28,720	5258	22618	27,856	218542	276680	4[illegible]
Annual increase in economic returns[4]			2274.			1,689			2,064			2[illegible]

Source: Computed from Tables 4.10, 4.10.1, 4.15 and 4.16

Notes :
1) as in Table 5.8
2) before road improvement: 46 Km @ 2/50 = 115/- per ton
3) as in Table 5.8
4) as in Table 5.8

Table 5.12: Economic returns from crop sales along Rudewa-Nongwe road (Masenge village)

	Maize			Wheat			Beans		
	Present	After road Improvement	Difference	Present	After road Improvement	Difference	Present	After road Improvement	Diff ence
Price (Sh/ton)	1750	1750		3000	3000		3500	3500	
Marketing margin[1] (Sh/ton)	263	131		450	225		525	262	
Net price (Sh/ton)	1487	1619		2550	2775		2975	3238	
Labour (Mandays)	48	48		56	56		110	110	
Labour costs @ 25/-	1200	1200		1400	1400		2750	2750	
Net price (Sh/ton)	287	419		1150	1375		225	488	
Transport costs[2] (Sh/ton)	45	23		45	23		45	23	
Net price (Sh/ton)	242	397		1105	1352		180	465	
Sales (ton/year)	17.7	19.5	1.8	17	18.7	1.7	102.8	113.1	
Total economic returns[3]	4283	7742	12045	18785	25282	44067	18504	52592	710
Annual increase in economic returns[4]			715			2298			47

Source: Computed from Tables 4.10, 4.10.1, 4.15 and 4.16

Notes : 1) as in Table 5.8
2) before road Improvement: 18 Km @ 2/50 = 45/- per ton
3) as in Table 5.8
4) as in Table 5.8

Table 5.13: Summary of economic benefits along Rudewa-Nongwe road

Village	Source of data	Net benefits	Net increase
Unone	Table 5.8	13,096	981
Mtega	Table 5.9	53,470	4,186
Nongwe	Table 5.10	42,019	3,378
Mkobwe	Table 5.11	587,545	31,079
Masenge	Table 5.12	352,049	17,926
Total Net Benefits		1,048,179	57,650

Table 5.14: Economic benefits associated with road improvement (Rudewa-Nongwe Road)

Year	0	1	2	3	4	5	6	7	8	9	10
Benefits:		1048179	1152997	1268297	1395127	1534640	1688104	1850914	2042605	2246866	2471553
Costs:											
Initial capital[1]	1464868										
Maintenance costs[2]	-	73242	73242	73242	73242	73242	73242	73242	73242	73242	73242
Yearly net benefits	1464868	934937	1078788	1195055	1321885	1461398	1614862	1783672	2969363	2173624	2398311

Benefit Cost B/C ratio = 5

International rate of return IRR = 50%

Source: Computed from Table 5.13

Notes : 1) The initial cost of improvement for Rudewa-Nongwe road was calculated using the ratio of the distance in Km multiplied by the cost of Myombo-Kidete road i.e $\frac{136}{88}$ x 951213

2) Maintenance costs were also calculated using the same ratio

5.9 Results for the Central Railway villages

5.9.1 Economic returns

Economic returns along the Central Railway are the flows of revenue from crop production resulting from easy transport both of the produce itself and of inputs. These are expected to be attracted by low transport cost charged. The economic returns from crop production along the Central Railway are presented in Tables 5.15 to 5.18. Table 5.19 shows the returns summarized from Tables 5.15 to 5.18. These are compared with similar returns from crop production along Myombo-Kidete and Rudewa-Nongwe roads. The purpose is to compare the production with that expected to be attracted by the improved roads.

Maize, beans and onions shown in Tables 5.15 to 5.18 are sold by the farmers in the four villages along the Central Railway. All the villages except Munisagara sold onions. Transport charges and marketing margins are the same except the distance from the villages to Kilosa where the produce is marketed. Given the land resources the amount of crop production would not vary widely among the villages. The similarity of crops sold depicts uniformity of soil conditions in the area.

Table 5.15: Returns on crop sales along the Central Railway (Kidete village)

Item	Maize	Beans	Onions	Total
Price at Kilosa (Shs/ton)	1750	3500	2700	
Less marketing margin (15%)	263	525	405	
Less transport costs[1]	36	36	36	
Labour (mandays/ton)	48	110	70	
Labour cost @ 25/-	1200	2750	1750	
Net revenue to farmer	251	189	509	
Tons marketed[2]	17.1	35	75.7	
Total economic benefits	4292	6615	38531	49438

Source: Computed from Table 4.10, 4.10.1, 4.15 and 4.16

Notes: 1) 42 Km @ 0.85 Shs/ton Km = 36/-

2) Marketed tonnes = Estimated crop sales for the season 1982/83 Table 4.15.

Table 5.16: Returns on crop sales along the Central Railway (Mwasa village)

Item	Maize	Onions	Beans	Total
Price at Kilosa (Shs/ton)	1750	2700	3500	
Marketing margin (15%)	263	405	525	
Less transport costs[1]	29	29	29	
Labour (Mandays/ton)	48	70	110	
Labour cost @ 25/-	1200	1200	2750	
Net revenue to farmer	251	509	189	
Marketed tonnes[2]	48.4	21.4	48.4	
Total economic benefits	12148	10893	9148	32189

Source: Computed from Tables 4.10, 4.10.1, 4.15 and 4.16

Notes 1) 34 Km at 0.85 Shs/ton Km = 29/-

2) as in Table 5.15

Table 5.17: Returns on crop sales along the Central Railway (Mzaganza village)

Item	Maize	Onions	Beans	Total
Price at Kilosa (Shs/ton)	1750	2700	3500	
Less marketing margin (15%)	263	405	525	
Less transport costs[1]	22	22	22	
Labour (Mandays/ton)	48	70	110	
Labour cost @ 25/-	1200	1750	2750	
Net revenue to farmer	265	523	189	
Tons marketed[2]	48.3	17.5	37.5	
Total economic benefits	12800	9153	7088	29,041

Source: Computed from Tables 4.10, 4.10.1, 4.15, and 4.16

Notes: 1) 26 Km @ 0.85 Shs/ton Km = 22/-

2) as in Table 5.15

Table 5.18: Returns on crop sales along the Central Railway (Munisagara village))

Item	Maize	Beans	Total
Price at Kilosa (Shs/ton)	1750	3500	
Less marketing margin (15%)	263	525	
Less transport costs[1]	14	14	
Labour (Mandays/ton)	48	110	
Labour cost @ 25/-	1200	2750	
Net revenue to farmer	273	211	
Tons marketed[2]	21.6	34.6	
Total economic benefits	5897	7301	13,198

Source: Computed from Table 4.10, 4.10.1, 4.15 and 4.16

Notes: 1) 16 Km @ 0.85 Shs/ton Km = 14/-

2) as in Table 5.15

Table 5.19: Summary returns on crop sales along the Central Railway

Village	Data source	Net returns
Kidete	Table 5.15	49,438
Mwasa	Table 5.16	32,189
Mzaganza	Table 5.17	29,041
Munisagara	Table 5.18	13,198
Total returns		123,866

5.10 Estimated incomes from crop sales along the Central Railway

The farmers incomes estimated from crop sales along the Central Railway of Shs 134,866/- are shown in Table 5.19. These are low compared with Shs 374,034/- and Shs 1,048,178/- (Tables 5.6 and 5.13) estimated to be produced along the Myombo-Kidete and the Rudewa-Nongwe roads after they have been improved.

The Central Railway farmers despite the train facilities they have been accessed to will not be able to produce enough crops to raise their incomes. The reasons being that the area has very little arable land, and the population distribution and labour force are low along the Central Railway (Tables 4.1 and 4.2). Equally the average area under crop cultivation per farmer of 3.1 ha. is low compared with 3.5 ha. and 4.3 ha. along Myombo-Kidete road and Rudewa-Nongwe (Table 4.7) and perhaps the degree of farmers response to road improvement is higher than farmers response to railway transport services. One obvious reason is that the road transport is easily adaptable to the crop and input transportation than it is with the railway.

Moreover the roads can be designed to pass through difficult terrains with more agricultural potential than can be done in case of the railway construction. However, this depends on the amount and availability of improved package and other infrastructures accompanying the road improvement.

One other thing to note is that in making estimates along the two roads, consideration of the induced costs as a result of road improvement has been made. The estimates are assumed to result from improved transport services (e.g. increased traffic volume on the roads, improved storage facilities etc) both for the crops and crop inputs and transport for extension staff. No such improved transport services (e.g. frequent train services, increased number of coaches etc.) are taken into consideration in estimating the incomes along the Central Railway.

Given enough arable land and improved regular train services and coaches, farmers along the railway would find it cheaper to transport the produce and inputs since transport cost per ton.Km by train is much lower than transporting the crop produce by road even on an improved one. The variation in incomes is due to land availability and labour per family. However, roads provide easier connection of villages and urban centres since they are open for use by a variety of modes of transport - bicycles, vehicles and animals whereas the railway use one mode of transportation locomotives. It appears that even if there are improved services and number of coaches to serve farmers along the railway still the volume of produce marketed along the two roads will be much more than that along the railway due to the variety of transportation models.

CHAPTER VI

DISCUSSION AND RECOMMENDATIONS

6.1 Farming Systems Results

The main objectives of the study as outlined in Chapter one were:

1. To find out where farmers in the Ukaguru and Rubeho mountain areas of Kilosa District market their produce, modes of transport available, kinds of inputs used in farming and where they obtained such inputs.

2. To examine the socio-economic situation of the peasant farmers in the area.

3. To evaluate the likely impact of rural roads programme on the development of the area and

4. To study the effect of feeder roads on agricultural extension services in the area.

In order to carry out these objectives, a farming systems survey was conducted along Myombo-Kidete, Rudewa-Nongwe roads and the Central Railway. Socio-economic data on families samples is shown in Tables 4.2 and 4.4. Data presented in Table 4.2 shows that families along Rudewa-Nongwe road have more persons in the family and larger labour force (7.2 and 3.2 persons) compared to (6.5 and 2.9) along Myombo-Kidete road and (5.1 and 2.8 persons) along the Central Railway.

Also average number of wives per family are slightly more along Rudewa-Nongwe road than elsewhere. This shows that given more land potential and farming inputs that is fertilizer, insecticides and intensive extension advice, farmers along Rudewa-Nongwe road are likely to produce more crops than farmers along Myombo-Kidete road and the Central Railway. This would hold if all the labour force available in the family is used for crop production, assuming all other factors are available in sufficient supply. The data presented in Table 4.4 shows that families along the Central Railway are slightly older than farmers along the two roads. It shows that the same families have more years of farming experience than farmers along Myombo-Kidete and Rudewa-Nongwe roads, though farmers along the Central Railway have fewer years of stay on the villages than those along the Rudewa-Nongwe road, but more than those along Myombo-Kidete road.

More years of farming experience indicate that farmers ability to produce more crops and adopt new farming techniques are higher along the Central Railway if land potential is available and accessibility to farm inputs, markets for their produce and extension services are available.

In the same Table 4.4 farmers along the Central Railway have lower percentage of formal education (primary 27.5% and secondary 15%) but a higher percentage of adult education 57.5% than those along the two roads. The level of education and farming experience are attributed to the age of the farmers. Young farmers who receive formal education migrate to urban centres to look for higher institutions and or jobs leaving the old farmers with adult education in the villages tilling the land. Such youth migration reduces the level of production hence the incomes per farmer in the villages. However, more years of formal education would act as incentives to easy adoption of innovations if there were roads and rural transport to provide easy access for farmers to agricultural inputs, like fertilizers and to new techniques and ideas (e.g. effectiveness of agricultural extension services and general crop husbandry).

In Table 4.5 more percentage of farmers who applied some agricultural inputs and those who received extension advice are shown along the Central Railway than along the two roads. This confirms that older farmers with many years of farming experience easily adopt new farming techniques. Similar results of the study carried out in Kilosa District show that older farmers who are experienced in farming were the ones who easily adopted new farming techniques (Kashuliza, 1981).

Cropping patterns:

Crop calendars and cropping patterns are similar in the three areas. Farm families' major crops are maize (the major food stapple), sorghum, rice, beans, vegetables, cassava and sweet potatoes. Cash crops such as wheat, cotton, coffee and sunflower are grown in one area or another depending on soil and weather conditions which are described in Chapter one. Table 4.6 shows that most of the crop activities are carried out between the months of November and May, which are rainy months. Crops are harvested between June and August which are dry periods. The times of rain are the same in the district and farmers have to utilize the rains before dry seasons begin. The average hectares under crop cultivation vary from area to area and from crop to crop. In Table 4.7 average hectares of each major crop are shown. In all the three areas (Myombo-Kidete, Rudewa-Nongwe roads and the Central Railway) maize is grown on a larger hectareage, indicating its importance to the farmer. Next to maize is beans grown on a higher hectareage and by more farmers than other crops. The two are the crops grown for food the surplus being sold. At the moment the two crops are next in value to cash crops grown in the area. Maize occupies 1.6 ha, and 1.0 ha. while beans occupy 1.1 ha, 0.6 ha. and 0.4 ha. along Rudewa-Nongwe, Myombo-Kidete roads and the Central Railway respectively. Also the total hectareage under crop cultivation yearly is 4.3 ha., 3.5 ha. and 3.1 ha. along Rudewa-Nongwe, Myombo-Kidete roads and the Central Railway. The Rudewa-Nongwe road area grows more crops and on large hectareage than the Myombo-Kidete road and the Central Railway. This is as a result of a labour force per family as shown in Table 4.2 and the weather and soil conditions stated in Chapter one. It is also due to the fact that there are many cash crops grown in the area (Wheat 0.4 ha. and Coffee 0.1 ha.).

Crop irrigation:

Irrigation plays a major role in the day to day farming in the study area. Maize as a major crop together with vegetables, onions, etc. are grown under irrigation systems, using Mkondoa and Lumuma rivers. In Table 4.9 average area under irrigated crops is 1.0 ha. along the Central Railway and 0.7 ha.

along the Myombo-Kidete road. Over 65% and 50% of farmers along the Central Railway grown maize and onions under irrigation system. Within the two areas maize occupies a large portion of the land area under crop irrigation 0.4 ha. along Myombo-Kidete road and 0.6 ha. along the Central Railway. Comparing Tables 4.9 and 4.7, it appears that irrigation contributes a large portion of the area under crop cultivation of about 32% along the Central Railway.

The major problem expressed by the farmers with regard to irrigation is the scarcity of land. Although maize occupies a large area fewer farmers grow the crop under irrigation than those who grow crops under natural conditions. The same farmers expressed that flood control during the rainy season is a major problem. Irrigation channels are dug haphazardly to let in water from the rivers to the fields without reliable control measures. Unwarranted flooding causes damage to crops and high soil erosion. In which case therefore technical irrigation practices are required if proper use of irrigation is to be achieved in the area. Irrigation channels should be built with control measures to allow in enough water when required so as to prevent flooding and soil erosion.

Cash incomes from crops:

Average cash incomes vary from area to area depending on the amount of crops sold and the marketing and transport facilities available to the farmers. Farmers along the Central Railway are accessible to the train facilities all the year round whereas those along Myombo-Kidete and Rudewa-Nongwe road depend on head porterage and at times seasonal unrealiable road transport. Table 4.12 shows that the average income is T.Shs 7,110/50 whereas elsewhere it is much lower especially along Rudewa-Nongwe road. Farmers along Rudewa-Nongwe road carry the produce on the head for many miles even during dry seasons. Unlike the farmers along Myombo-Kidete road who receive some road transport during the dry seasons, most farmers along Rudewa-Nongwe road especially in Mtega and Unone villages have to travel several miles on foot carrying the produce. It implies that the farmers have to sell just enough crop to obtain cash to buy essential items such as salt, sugar, clothing and farm tools that is, hoes and pangas. Table 4.16 shows that the distances covered by the farmers along the Central Railway are long hence discourage crop sales.

Off-farm employment:

Opportunities for off-farm employment are scarce in most of the villages. The few that exist include grade teachers working within the primary schools in the area and employees of the railway authorities in case of farmers along the Central Railway, and some petty traders. In all the extra cash earnings were very low Table 4.13. There are shortages of employment opportunities due to the poor infrastructures in the area. There are no factories and estates in the area where off-farm employment can be sought. The sisal estates and hotels that exist are far away in Kilosa and Kimamba towns and in Gairo. Unless farmers have to migrate to the towns they cannot be able to commute between their villages and towns where job opportunities exist.

Health facilities:

There is an apparent shortage of health facilities for both human and livestock. None of the villages surveyed has a hospital or a health centre, or is within easy reach of one (Table 4.18). A few fillages have dispensaries and first aid boxes but none is able to handle serious cases. Farmers have to walk tens of kilometers to the hospital, at times carrying very sick relatives on stretchers. This implies that farm time is spent between the villages and the hospitals in Kilosa, Kimamba and Gairo. Little time is left for farmers to concentrate on farm activities. Farmers cannot therefore settle down to adopt farming techniques which require good husbandry attention.

Livestock health centres and drugs are also not available in the area. Livestock is kept under traditional husbandry practices. The animals commonly kept are goats, sheep and poultry and only along Rudewa-Nongwe road in Nongwe, Mkobwe, Masenge and Mtega villages cows and donkeys are kept. The number kept is very small. Only an average of 2.5 cows and 0.2 donkeys are found in the area. The number may be due to the lack of animal health clinics and veterinary extension workers in the area. It can be said that this limits incomes which can be obtained from the sale of animals and animal products. It also limits the amount of proteins from animal products which are badly needed by children and lactating mothers.

Other infrastructures:

The study revealed that there are few educational, administrative, community centres and no storage facilities in the area (Table 4.18). There are no post primary education facilities available. Only primary schools are found in the area. Primary school leavers have to migrate to towns to look for higher education facilities. In the event of failing to secure places in secondary and vocational schools, they linger in town looking for job opportunities. The influx of school leavers into the towns leaves villages under populated causing over population and shanty settlements in the urban surburbs. In sum total rural urban migration results from lack of rural infrastructures that is rural roads and rural transport, rural vocational schools and village small scale industries which can offer rural employment. Lack of such infrastructures cause extension workers to shun rural areas hence intensifying rural illiteracy and exacerbating subsistence economy. Providing rural roads and rural transport and other necessary infrastructures which link up rural areas with the urban centres will break through the bottlenecks. It will improve food supplies in the towns and increase input and consumer goods in the rural areas. Employment opportunities are likely to open up and increase incomes of the rural population hence raise standards of living in the rural areas. Such facilities are likely to open up more land for agricultural production (crop and animal husbandry) and attract moving back to the land of the urban unemployment, reducing urban population congestion.

6.2 Analytical Results

The analytical results obtained by comparing annual net flows from road users' benefits and induced agricultural benefits with the annual costs of Myombo-Kidete road are presented in Table 5.7. Those obtained by comparing annual net flows from induced agricultural benefits with the annual costs of improving Rudewa-Nongwe road are presented in Table 5.14.

6.2.1 Myombo-Kidete road

The B/C ratio obtained from the annual net benefits compared with annual costs of Myombo-Kidete road project is 3.1. This implies that it is beneficial to improve Myombo-Kidete road to all weather conditions motorable throughout the year. This ratio is rather high due to road-users' benefits included in the calculating the annual net flows used to derive the B/C ratio. Road-users' benefits are expected to come from the generation of new traffic which did not exist before but not from the existing traffic as in the case of the road-users' benefits along Myombo-Kidete road indicated in Table 5.1. Inclusion of such benefits has in some way contributed to over estimating the net benefits hence the B/C ratio and the IRR. However, the area already produces a reasonable amount of cash crops. And evaluation of feeder roads using road-users savings is often appropriate in areas where the level of economic activity is already substantial (Mwase, 1978).

The IRR obtained from the annual net flows compared with the annual cost is 49%. This rate is exceptionally high for feeder roads such as Myombo-Kidete road. The factor which contributed to this high rate was the annual crop increase estimated using 10%. There is no clear evidence to show that improvement of Myombo-Kidete road or Rudowa-Nongwe road would induce agricultural production to grow at an annual rate of 10%. However, since there is already an annual growth of 5% without road improvement, the rate would be much higher than the present rate if the road improvement is accompanied by improved packages and competent extension workers. In addition the area has enough population with adequate labour force of 2.9 persons per family (Table 4.2) and potential land for agricultural production especially around Dodoma and Chabima villages. And the cost of production is low T.Shs 951,213/- compared to annual net flows presented in Table 5.7. Thus improving the road would probably allow easier transport both of inputs (e.g. fertilizer) and of the produce hence induce greater agricultural production. It is also likely that improvement of the road will attract both economic and social activities but the degree at which these economic and social factors will be attracted is hard to measure. It could as well detract these economic and social factors. Improvement of feeder roads may attract rural people to migrate to urban areas unless the improvement is accompanied by economical and social incentives such as job opportunities, recreational facilities, health centres, schools, markets and marketing facilities. Short of these the improvement of the road will drain the rural areas of the potential manpower.

6.2.2 Rudewa-Nongwe road

The results of analysis from the induced agricultural benefits annual net flows compared with annual costs of the project revealed a B/C ratio of 5. The ratio indicates that the project is highly viable.

However, B/C ratio is not the best measure of judging road projects especially feeder roads where there are no traffic volumes on the road. Similar B/C ratios calculated on Buyagu cotton roads and Buchenzi-Karumo and Sengerema-Katunguru roads show 4.0 and 5.4 (Halcrow, 1966). In the case of Rudewa-Nongwe road, the road passes through an area of very high agricultural potential. There is considerable amount of cash crops that is Coffee and Wheat grown in Nongwe, Mkobwe and Masenge areas. There is also considerable land available in the area with good weather and soil conditions favourable for crop cultivation as indicated in Chapter one. The area has high population potentials and high average labour force of 3.2 persons per family (Table 4.2). The only obstacle is that the road passes through a difficult terrain with deep valleys which will cause difficulties in engineering construction.

The internal rate of return obtained from the annual net flows of induced agricultural benefits is 50%. This rate is exceptionally high compared to the minimum of 10% nationally accepted for the evaluation of road projects in Tanzania. Internal rate of return IRR is a rationale used to judge profitability of projects above the standard accepted rate, but does not give an upper limit of acceptance. The project is therefore profitable since it will generate enough proceeds to repay the principal and interest and still have enough maney left. What should be noted is that there is no direct and simple causal relationship between road investment and the increase in agricultural production. Variables such as economic development potential of the area, its structure, market conditions and sociological components (e.g. population response to transport economic impulses, etc.) were had to qualify hence not applied correctly in the analysis. It is true that the increased production may follow improvement of the road, such increase if any for an isolated road project would be negligible unless followed by integrated package. It is nevertheless a reasonable attempt of road evaluation in the absence of data on engineering costs and know how.

6.3 Conclusions and Recommendations

The main aim of the feeder roads programme was to provide the rural people with socio-economic facilities thereby enabling them to increase production which in turn will raise their incomes and standards of living.

In order to carry out the above objectives, a study was conducted along Myombo-Kidete, Rudewa-Nongwe roads and the Central Railway in the Ukaguru and Rubeho mountain areas of Kilosa District. The basic concern of the study was to examine problems faced by the farmers with regard to the marketing of the agricultural produce and receiving inputs and of gaining easy access to social infrastructures and to suggest ways of solving such problems.

One shortcoming of the programme was the lack of traffic on the roads which would be used to generate development benefits once the roads are improved to all weather conditions. The study showed that resources are scarce along Myombo-Kidete road and the Central Railway and abundant along the Rudewa-Nongwe road but lack optimal use. The virtual absence of rural roads and rural transport for the transportation of inputs to the villages and the produce to the markets means that farmers cannot easily develop themselves. There is also an apparent lack of qualified personnel for extension purposes and lack of other necessary infrastructures to link the farmer to the markets for his produce and to gain access to industrial consumer goods.

The study also revealed that there is enough economic activities (cash and food crops being grown in the area) to justify the road investment. Both feeder roads will generate enough incomes to repay the capital investment that will be incurred. Already there is considerable amount of produce being grown in the area e.g. coffee and wheat in the Ukaguru mountain areas, cotton and onions along Myombo-Kidete road, maize and beans which contribute substantial amount of farmers' incomes. However, low prices paid for most of the crops (maize, beans and cotton) discourage farmers from growing the crops for commercial purposes. In addition to the crops grown in the area, there is a considerable amount of livestock, especially the Ukaguru mountain areas in Nongwe, Mkobwe, Masenge and Mtega villages but there is serious lack of veterinary health centres, drugs and extension service personnel.

In order for the people of the Ukaguru and Rubeho mountains to develop themselves economically and socially, the following recommendations are made:

1. Kilosa District Rural Development Programme being undertaken should not hesitate improving the two roads to all weather standards. The improvement

of the two roads will attract enough incomes to repay the initial capital investment and recurrent expenditures leaving enough to the farmers to develop themselves. Farmers will improve their farming methods by applying improved package - fertilizers, insecticides, adopting grade cows since livestock health centres will be available and drugs obtained easily and at economical prices. Farmers will be able to market their crops and livestock products in urban centres e.g. Morogoro, Dar-es-Salaam when roads are improved to all weather conditions and vehicles made available, hence increasing road and vehicle operating cast savings.

2. The District authorities should undertake to reconstruct the Rudewa-Nongwe road to all weather conditions as soon as possible when the work of improving Myombo-Kideto road already started has been completed, or when funds become available. The improvement of Rudewa-Nongwe road will attract cash crop production namely coffee and wheat which are already in existance in the area. It will also attract livestock production in the area.

3. Once the roads have been improved, the Government or the District should step up extension services both in number mobility and skill or expertise for both livestock and all crop (food and cash). Provision of extension staff will increase contact and confidence between farmers and extension workers and will increase the innovation diffusion process.

4. As a corollary to the above, it is recommended that adequate inputs both for the livestock and crops in the area and the District as a whole be introduced to the farmers as soon as the roads are improved, in time and sufficient quantity. To do this the government should build storage facilities at the village level or in central village(s) where farmers will be able to store their crop produce awaiting transportation to the markets and store the required inputs. These facilities will help to ease the problem of vehicles going empty to carry the produce from the villages or returning empty after delivering the inputs. This should be done as soon as the co-operative societies are revived. The process will also cut down the amount of crop losses due to lack of storage facilities. Such adequate intermediate storage facilities will also help to maintain buffer

stocks which can be used to alleviate food shortages in the district and other parts of the country.

5. Prices for most crops sold, maize, wheat, beans and cotton should be raised to economical levels which will enable farmers to realise surplus income after deducting all costs of production and marketing. Higher prices offered for the crops will act as production incentives.

6. Should funds become available health centres for people should be built one in Lumuma village, one in Nongwe and a livestock health centre in Nongwe or Mkobwe to step down unnecessary travel to Kilosa and Gairo for health services. Time and energy saved will add to the production of more crops.

Finally post primary institutions (secondary and vocational) should be built in the area to facilitate farmers' children to continue their formal education after primary. This will help the children to mature while still in schools and could become self-supporting whenever they take up responsibilities especially those who do not make it to go to higher institutions - University etc. Vocational institutions will open up opportunities for employment.

REFERENCES

Adler, H.A. 1967. Sector and project planning in transportation, some thoughts of feasibility studies, Washington, D.C. World Bank Occasional paper No. 4 pp 231-6.

Adler, H.A. 1971. Economic appraisal of transport projects, a manual with case studies, Indiana State University Press, Bloomington, London.

Adler, H.S. 1971. The economic evaluation of transport investments, Indiana State University, Bloomington London.

Bierman, H. and S. Smith. 1966. Capital budgeting decision. Economic analysis and financing projects. MacMillan, New York.

BRALUP, 1971. Agro-economic zones of Morogoro Region, Research paper No. 47 pp 42-79. University of Dar-es-Salaam.

BRALUP, 1971. Road feasibility studies in Tanzania, Research paper No. 16 May, 1971.

Carnemark, C., Biderman J. and Bovet, 1970. The economic analysis of rural projects, World Bank Staff Working paper No. 241, Washington D.C.

Coupland, R. 1968. The exploitation of East Africa, 1856 - 1890, the slave trade and the scramble, London, second edition.

Eberlie, R.F. 1960. The German achievement in East Africa, Tanganyika notes and records No. 55 September, 1960. Dar-es-Salaam.

East African Royal Commission Report 1953-1955. H.M.S.O. London.

FAO, 1963. U.N. Food and Agriculture Organization, The state of food and agriculture, 1963 (Rome: FAO, 1963), p. 137.

FAO, 1964. U.N. Food and Agriculture Organization, 1964 (Rome:FAO, 1964), p. 125.

FAO, 1977. U.N. Food and Agriculture Organization, The state of food and agriculture, some factors affecting progress in Food and Agriculture in the developing countries (Rome, FAO, 1977) pp 2-50.

FAO, 1981. U.N. Food and Agriculture Organization, Agriculture towards 2000, Access: The social and institutional framework (Rome, FAO, 1981) pp 85-104.

FAO, 1981. U.N. Food and Agriculture Organization, Population Year Book Vol. 35 pp 1-20 (Rome, FAO, 1981).

Gilbert V. Richard. 1965. The works programme in East Pakistan, Development digest, Vol. 3 No. 2. National Planning Association, July 1965 pp 19-30.

Gilg, A.W. 1980. Country side planning year book Vol. 1 Norwich Geograph abstracts Ltd.

Gillman, C. 1942. A short history of Tanganyika railways, Tanganyika notes and records No. 12-5 (1941-43) Dar-es-Salaam.

Gittinger, J.P. 1972. Economic analysis of Agricultural projects. The John Hopkins Press, Baltimore.

Haim Levy and Marshall Sarnat, 1978. Capital investment and financial decisions, Prentice Hall International, London.

Halcrow, Sir William and Partners, 1966. The feasibility of improving the Buchenzi-Karumo road and of constructing a road from Sengerema to Katunguru. Moshi-London. September 1966.

Harlow, V.E. Chilver and A. Smith, 1965. History of East Africa, Oxford University Press.

Haveman, R.H. 1970. The economics of the Public Sector (Introduction to economic Series). Wiley Krieger, 1970.

Hofmeier, R. 1973. Transport and economic development in Tanzania. I.F.O. Africa-studien Nr. 78, Munich, Welfform.

Hunter Guy, 1978. Agricultural development and rural poor. Declaration of Policy and guidelines for action, overseas development institute, London.

Ford Foundation, "India's intensive agricultural district programme", India Program Letter 134. (mimeographed, New Delhi, July 10, 1964).

IBRD, 1961. The economic development in Tanganyika, Baltimore p. 277.

IBRD, 1974. Roads and road transport in Tanzania. Agriculture and Rural development sector study. IBRD report 541a - Ta Vol. II Annex 8.

Israel, A. 1970. Appraisal methodology for feeder roads projects, World Bank Economic Department working paper No. 70 Washington D.C. March.

Jones, O. William, 1961. Food and Agricultural Economics of Tropical Africa, Food Research Institute Studies, Vol. II No. 1 p 10 Stanford University.

Jones, O. William, 1965. Environment, Technical Knowledge, and Economic Development in Tropical Africa, Food Research Institute Studies, Vol. V No. 2 p 112. Stanford University.

Jones, I. William, 1970. Agricultural Project analysis. M'pesoba rural road project (Mali), IBRD report No. PTR 52a.

Kashuliza, A. 1981. Farming systems in selected villages in Kilosa District with special reference to the bean crop. B.Sc. Special Project. University of Dar-es-Salaam, Morogoro.

Kuiper, E. 1971. Water resources project economics, Butterworth and Co. Ltd. London.

Lewis, Arthur, W. 1955. Theory of economic growth, London, George Allen and Unwin.

Lister R. Brown, 1965. Population growth, Food Needs and Population Problems, World Population and Food Supplies, 1980: American Society of Agronomy, February, 1965 p 11.

Maeda, J.H.J. 1976. Population participation, contract and development, a study of the nature and role of popular participation in Tanzania's rural development. Unpublished doctorol dissertation. Department of Political Science. Yale University pp 163-65.

Mbilinyi, S.M. 1968. Agricultural Research for rural development Vol. 6. East African Literature Bureau.

McCall, M.K. 1977. Political Economy and rural transport. A reappraisal of transportation impacts. A radical Journal of Geography Vol.9 No. 1 February.

McCall, M.K. and Skutsch, M.M. 1978. Tabora Region Feeder road study. A review Journal of Geographical Association of Tanzania No. 16 pp 140-9.

McCall, M.K. 1981. Regional Transport Planning for Social Development in Tanzania. Dec. 1981.

McKay, J., Goshi, T. and Hameer, S. 1971. Methodology for road feasibility studies in Tanzania. A review of previous techniques and some recommendations for the future. BRALUP Research paper No. 16, University of Dar-es-Salaam, May, 1971.

Mkama, J. 1969. Transport Planning in Tanzania. An assessment. BRALUP Research paper No. 8, May, 1969.

Moffel, J.P. 1958. Handbook of Tanganyika, Government Printer Dar-es-Salaam.

Ngila Mwase, 1978. Economics Research Bureau, paper No. 78.3. A survey of transport studies in Tanzania, University of Dar-es-Salaam.

Norman, D.W. 1978. Farming systems research to improve the livelihood of small farmers, Canadian Journal of Agricultural Economics, Proceedings. Joint annual meetings. AAEA-CAES Blacksburg, Virginia p 814.

O'Connor, A.M. 1965. "Railway Construction and the pattern of economic development in East Africa" Transactions of the Institute of British Geographers, 36.

Odero-Ogwel L.A. and Mlambiti, M.E. 1975. Population, employment and rural development in Tanzania. FAO (UNFPA). Seminar on Agricultural Planning and Population.

Ogot, B.A. 1969. "Zamani" East African Publishing House, Nairobi p 256.

Omari, C.K. 1976. Strategy for Rural development, Tanzanian experience, East African Literature Bureau.

Ominde, Legale Cahusal, 1971. Urbanization and environment in Kenya, U.N. Conference on human environment.

Owen L. Edgar, 1965. Development through Democratic Institutions. Unpublished manuscript.

Owen, W. 1965. Transport and Food: in Transport and National Goals by Edwin T. Haefele editor. Brookings Institute, Transport Research Program, Washington D.C. pp 86-104.

Owen, W. 1965. Promoting Agriculture and Rural Development, Distance and development in Transport and Communications in India by Edwin T. Haetele editor - Brookings, India.

Pakistan Academy for Rural Development. Fourth annual report, June 1962 - May 1963. Comilla, East Pakistan, 1963.

Pratt Mildoed, 1928. A study of the development of social welfare in a selected group of African countries - Ghana, Sierra Leone, Kenya and Tanzania, University of Pittsburgh. Ph.D. Thesis 1969.

Ralph M. Parsons' and Co. 1963. (all Los Angels - New York). Feasibility study for the Kyaka-Bugene road, 1963.

Shayo, S.A., Mlay, G.I. and Anandajayasekeram P. 1982. Evaluation of the Iringa Resolution "Siasa ni Kilimo". Performance of Food and Cash.

Smith, E.W. 1955. "The earliest ox-wagons in Tanganyika: an experiment which failed", Tanganyika Notes and Records No. 40, Dar-es-Salaam,pp 1-14.

Smith, Ian. 1968. The Western Nigerian Road Development Survey, Journal of Transport Economics and Policy Vol. II, No. 1 January,1968 pp 94-104.

Stanley, W.R. 1971. "Evaluating construction priorieties of farm-to-market roads in developing countries, A case study". Journal of Developing Areas, April,1971.

Sychrava, L. 1969. "Some thoughts of feasibility studies". Journal of Transport Economics and Policy Vol. III, No. 2 May,1969 pp 332-48.

Development Plan for Tanganyika 1961/62 - 1963/64. Tanzania First Five Year Plan for Economic and social development, 1st July, 1964 to 30th June, 1969.

Tanzania Second Five Year Plan for Economic and Social Development, 1st July, 1969 - 30th June, 1974.

Transport and Road Research Laboratory (TRRL) appendices I and II. 1976.

Umalele, 1975. The design for rural development. Lessons from Africa, A World Bank Research Publications, The John Hopkins University Press, Baltimore, London.

United Research Institute (URI), 1969. A study of feeder road development in six areas of Tanzania Vol. I - VII Boston, Sept. 1969.

U.S. Department of Commerce, Bureau of Public Roads, The Local rural road problem, January,1950. Washington D.C.

Wilson, W.G., Bermann, R.B. Hirch, V.L., Klein, S.M. 1966. The impact of highway investment on development. Brookings Institute.

World Bank (1972). Transportation: Sector working paper Washington D.C. World Bank.