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THE ROLE OF BICYCLES IN RURAL TRANSPORT:
A CASE STUDY OF *NGWARE-INI* OF NYANDO DIVISION.

BY

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A thesis submitted in partial fulfilment for the degree of Master of Arts (Planning) in the University of Nairobi.

1996

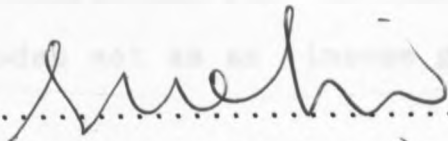
DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.



M. K. Otieno
(Candidate)

This thesis has been submitted for examination with my approval as University Supervisor.

Signed..........Supervisor
Dr. S. V. Obiero

Abstract

The use of the motorised modes in rural areas have been found to be low due to the fact that they are inaccessible to the majority. The inaccessibility can be attributed to low income level and low surfaced roads connectivity, hence, the rural inhabitants tend to use the non-motorised ones because of their ease in operation, ownership and hire. They can also move on low quality footpaths and roads.

This study, carried out in Nyando/Kadibo Divisions, was aimed at covering bicycles operating in off-road transportation of both passengers and goods for various trip makers. These bicycles are known as *Ngware-ini*. According to the research findings, the mode offers fast service and is giving the *matatus* operating in their routes a stiff competition. The number of bicycles have been increasing for the past seven years. The operation of these modes act as an income generating activity in the region.

The main objective of this study was to examine factors favouring the use of these modes. Other objectives were to assess whether the operation can offer productive employment, the type of transport needs they fulfil, possible problems they face and to make recommendations for their efficient use.

During the field survey, cluster stratified random sampling technique was devised and adopted for use in data collection. Sub-locations were therefore taken as clusters used as sampling units through which elementary units, that is, the households

were identified and interviewed. Matatu and Ngware-ini operators were interviewed using the systematic sampling while bicycle repairers and passengers interviewed randomly.

The findings of the study revealed that Ngware-inis transport more passengers along the transport corridors than matatus in the off-road transport. The average monthly income generated from Ngware-ini operation is higher than that generated from the agricultural produce in the region. Ngware-inis were also found to offer both direct and indirect employment and employ more operators compared to matatus in the divisions. In the process of their operation, they assist in traffic build up along the main transport corridors. In goods movement, Ngware-inis are suitable in transportation of rice, vegetables, sugarcane, shop merchandise and furniture among others.

In terms of the nodes' social and economic viability, they control matatu fare increases on their routes, can be repaired locally and some of their parts fabricated by the jua kali artisans in the region.

The study recommends that there is a need to further create awareness on the suitability of the nodes in the region, construct their parking terminals along transport corridors in the markets and avail credit for them to enhance the activity.

ACKNOWLEDGEMENT

My special gratitude goes to the government for giving me a scholarship to pursue this course. I am also indebted to the members of staff of the Department of Urban and Regional Planning for their thorough training during the study.

I wish to express my sincere thanks to my supervisor Dr. Obiero S. V. whose cooperation and wise guidance helped in clear understanding of the topic of study and the successful completion of the work. I also extend my sincere thanks to Dr. Ngau P. M. whose critical comments helped in shaping the work. On the same note, I would wish to acknowledge the critical and positive comments from my colleagues during the periodic thesis review seminars.

I am also indebted to my parent, brothers and sisters who during the gruelling academic moments continued to encourage and support me. Not forgetting, I would also extend my sincere thanks to all friends, relatives who in one way or another assisted in successful the completion of this work.

I would also like to thank all my respondents during the survey and in particular the Ngware-ini operators who spared their time to give me the detailed and relevant information.

Special thanks goes to my wife Rose who through out the study, was patient and gave all the necessary support I needed.

DEDICATION

THIS WORK IS DEDICATED TO MY WIFE

ROSE

MAY GOD BLESS YOU

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LIST OF ABBREVIATIONS

- GoK : Government of Kenya
- IRFTD: International Forum for Rural Transport Development
- ITDG : Intermediate Technology Development Group
- KIC-K: Kisumu Innovation Centre- Kenya
- NGO : Non Governmental Organization
- RARP : Rural Access Road Programme
- SPSS : Statistical Package for the Social Sciences
- UNIDO: United Nations Industrial Development Organization

CHAPTER ONE

THE INTRODUCTION

1.0.0 THEORETICAL FRAMEWORK

1.1.1 Rural Transport

Rural transport, for a long period of time, have been associated with the agricultural production and in particular the transportation of the agricultural products to the markets. This explains as to why the main focus of rural transport planning and studies have conventionally been on the off-farm transportation (Barwel, 1985). Because of this view most of the rural population trips were thought to be mainly agricultural purpose ones.

On the other hand, agriculture was seen as the main economic activity that could alleviate rural poverty and this could only be achieved through marketing of the agricultural products. In order for the marketing of these products to be efficient, good means of transport was therefore necessary for the rural-people. This included the construction of roads and the incorporation of the motorised nodes which are faster and could carry many goods. This is because it was discovered that the former non-motorised nodes of transport as human portorage, animal carts and bicycles could not facilitate easier and faster movement of the products. Since the roads and motor vehicles recommended could not reach all the rural inhabitants, it was assumed that the off-farm transport was between the farm and the roadside and between the roadside and the markets (Barwel and Howe, 1979).

This approach to rural transport planning emphasised mostly the construction and improvement of the motorable roads and the

incorporation of motorised modes with the assumption that many rural population will be using the motorised transport and possibly that the rate of motorised modes ownership will increase. General observation and studies have disproved this assumption since the majority of the rural population still walk on foot or use other non-motorised modes like bicycles to market centres and other places.

Beenhakker (1987) also pointed out that rural transport demand is not basically made of agricultural trips but much of it is associated with day to day living, social activities and other occupational activities. Most of these activities do not require motorised means of transport since the distances are short, goods are of smaller quantity and speed is not a severe problem. A study carried out in Kenya on rural transport reveals that the improvement of rural transport with a bias towards the motorised modes have caused such problems as the reduction of labour demands following the replacement of traditional movement methods by the motorised vehicles, demise of cottage industries due to competition from urban areas leading to the partial collapse of wider rural economy and hence migration to the towns, changes in production towards transport intensive products which mostly do not benefits the poor (World Bank, 1976).

Past studies have also indicated that there is lack of enough knowledge on how widely used and applicable are bicycles in Africa. The modes rarely do appear in official statistics either at national or international levels (Hathway, 1985 & Beenhakker, 1987 UNIDO:1979). This means that these modes of transport seem to have had no great importance to be considered

for official recognition and hence they have been neglected even in planning.

In Kenya, transport policy for the rural areas was stated in the 1970-74 Development Plan. Rural transport, just like in other countries was viewed in the light of agricultural development and motor transportation. Roads were to be constructed for the rural inhabitants for the quick transportation of their agricultural produce. At the same time it was to link them to the railway line where the bulk of the produce could be easily exported to other areas. This led to areas having high agricultural potential to be well served with roads unlike those of low agricultural potential (Obiero, 1977).

However, for the past few years, the need for sustainable rural transportation has been realised. Rural access roads have been and still being constructed to improve the mobility of the rural residents. However, they are faced with such problems as inconsistent maintenance, lack of finance for fuelling and purchase of murrum for maintenance. The bias in rural transport towards motorised transport in Kenya have also been noticed in past studies. For example, most of these studies have majorly concentrated on the provision of rural access roads and motorised modes with few on the non-motorised transport modes (Obiero:1978, Njenga:1991, Madungha:1975, Kimani:1990)

Even though little is known about bicycles for example, their study and recommendations for improvement can alternatively enhance both the economic and social development of the rural areas by increasing accessibility, transport capability and minimising the infrastructure investment (op cit). Bicycles also

have less effect on the wear and tear of the roads as compared to the motorised ones. Studies have also revealed that the majority of the rural people used non-motorised transport as compared to the motorised ones. The use of these modes on the other hand can lead to the development of the local industries which can alternatively provide new employment opportunities to the rural inhabitants.

It can be pointed out here also that the public policy on the infrastructural provision in the rural areas have been biased due to the conventional approaches that have been adopted and applied. It is because of this reason that transport problems faced by some of the rural communities have not been fully catered for in the policy. International Forum for Rural Transport Development (IFRTD) (1994), pointed out that, there is a need to adopt new approaches in order to understand the real rural transport problems. The body identifies some of the key rural transport problems as:

1. inappropriate planning framework for rural transport
2. lack of clear national policies and attention to rural transport
3. insufficient development of appropriate technology and
4. lack of information on the available technology.

These explain as to why there is even lack of enough studies on rural transport especially on the non-motorised modes. In Kenya little attention has been given to the appropriateness of non-motorised modes in rural transport.

1.1.2 Bicycle mode of Transport

Bicycles were first manufactured in the European countries in the late nineteenth century. It was one of the modes that were invented to ease and encourage faster travel apart from the animal carts.

Bicycles continued to gain popularity from the time of their invention in different parts of the world. It was seen as a vehicle of liberation that was accepted in all circles till late 1940s. However, from mid 1950, due to the rise of motorised modes ownership, the bicycle's popularity started to decline in the developed nations. The reasons were that the motorised modes were considered to be modern and faster as compared to the bicycles. However, this notion started and has continued to change due to the problems that have been associated to the motorised modes as rise in the number of accidents, traffic congestion in the towns, environmental pollution, low car ownership and use and the rising oil prices among others. These problems have led to the re-consideration of the bicycles as an alternative mode of transport both in the urban and rural areas.

The usefulness of bicycles in meeting transport demand has been well documented. Hirotsuka (1994), pointed out that bicycles are popular world wide because they are inexpensive, can carry some loads, and provide faster movement as compared to public buses in short distances. He further points out that they are more efficient and faster in door to door services than motorised modes as buses. This was found out in T city near Tokyo where the majority 57.9%, 48.7% and 68.4% of the students, the aged and the house wives respectively said that bicycles are accessible

and faster in door to door services.

Malberg-Calvo (1992), asserted that in rural areas, bicycles play such transport roles as travelling outside the village as going to the market or town centres, going to work or social visit. Bicycles are also used in rural areas by traders in the transportation of their commodities to the markets and at some levels, they are used in commercial passenger transport. In rural areas of Malaysia for example, bicycles were found to be useful in the movement of goods and other non-agricultural trips (Barwel et al 1985). The reasons encouraging their use in rural areas is attributed to lack of enough motorised transport services hence it becomes the immediate alternative mode to walking. The other reason is that much of the travels in rural areas are on paths and narrow tracks which are accessible by track vehicles as the bicycles (Howe & Dennis 1993).

One of the aspects that has not been clearly understood is the role and co-ordination of various transport modes both in the urban and rural areas. Due to the uniqueness of these modes at different traffic levels, they assist each other in either goods transportation or passenger transport. In rural areas, it has been clearly documented that there is inadequate motorised transport modes mainly because of their poor road system. These modes operations are mostly concentrated along the main transport corridors (tarmacked roads) as compared to the murraned ones. However, at certain level of travel, the rural inhabitants are forced to use them to various destinations. There has been a gap in knowledge on how these modes co-ordinate. In rural areas where bicycles are used in passenger transport, they mostly

transport people to and from the main transport corridors.

In Africa, bicycles are the next important mode of transport from walking. It has an advantage over the latter in that it uses less human effort and it is faster. The other factors encouraging their use in rural Africa in the low income levels experienced which deter many from either owning or using the motorised modes. On the other hand, the ownership of bicycles in some rural areas have been as a result of its availability, its familiarity by the people, the terrain conditions and people's attitude towards the modes, for example many see it as a status symbol in Africa.

In Kenya, the importance of the bicycles has been realised and currently more emphasis is being laid by the government on the improvement of their facilities mostly in the urban areas (Kenya, 1994). They are now being recognised as important modes for passenger transport and plans are under way to segregate their paths in order to reduce possible accidents between them and the motorists, rehabilitation and maintenance of the roads and provision of other facilities to enhance their safety. However, little research has been dedicated to their roles particularly in the rural Kenya.

Bicycles, particularly in the Asian countries have been found to be viable in the commercial goods and passenger transport both in the urban and rural areas. Even though such an activity can be vital in Kenya it has not been given-keen attention in order to ascertain the potentiality of bicycles in it. Barwel 1993, revealed that in Sub-Saharan Africa, it is only the "boda boda" bicycles of Uganda that are non-conventional

modes offering such services and have been properly studied. He further points out that they are viable in rural transport in that buses operate long distances and maintain routes where they can generate enough income to cover investment and operating cost for the maximization of profit. This implies that in some areas they cannot maximize profits, their operation either ceases or are intermittent but with high fare charges as experienced in some parts of rural Kenya.

The buses and matatus therefore leave a service gap that such modes as the bicycles can fill and in some cases can play better roles than these conventional ones. A Study carried out in Uganda further revealed that the "boda boda" bicycles have to a certain extent replaced motor vehicles in some routes (Malberge-calvo,1982). They were found to operate in flat terrain, mostly in short distance trips and are efficient in their operation. Because of these qualities many like them because they facilitates access to economic and social services in needed time. Apart from these services, they also have income generating potential when they are used for hire purposes both in the movement of people and goods. In goods transport alone, it was found out that in 1992 "boda boda" generated \$933 with an average annual income of \$225 (Howe & Dennis, 1993).

In another study carried out in Tanzania on bicycle hire, it was found out that the activity increased the demand for bicycles. The high demand led to the increase in the number of shops selling bicycles and the number of people either employed in either bicycle operation and repair(Doran & Njenga, 1992). The findings of this study further proves that bicycles are rural

transport modes with the potentiality both in transport services and employment creation.

It is interesting to note that even though "boda boda" started between the Kenya-Uganda boarder, the phenomenon is well established in Uganda than Kenya. This can be attributed to the high value placed on motorised transport and lack of studies on the usefulness of these modes to the rural population. In Kenya some of the studies that have been carried out on bicycles are mostly concentrated in the urban areas (Rukunga,1990). The main emphasis of these studies have been on the full incorporation of these modes in the urban transport system to serve mostly the low income groups. However, they do not recommend them as suitable modes that can be used in the commercial passenger transport as in other Asian countries.

It is important to note that in rural areas of Kenya, the use and ownership of these modes may not be fully tied upon income levels but their prevalence, terrain conditions, travel time and values that are attached to it. Because of the assumption that rural income is very low, it may also be assumed that they cannot manage to purchase these modes and hence they will continue to either walk or use other motorised modes and hence planning for the bicycle facilities may not be paramount.

There is therefore a need to fully study and understand the role of bicycles in Kenya particularly in areas they have operated for a long period as Nyando. Nyando is one of the areas in Western Kenya where bicycles have been in use since the arrival of the colonialists. Since then, the mode has been gaining popularity both in the transport of passengers and goods.

This because of the flatness of the area, values attached to it and its economic aspects. In the last point, it has been discovered that rural households will mostly purchase or invest in a mode only if it can be used to increase their income either directly by transporting their goods to markets or indirectly if it reduces their travel time (Howe and Dennis 1983).

1.1.3 The problem statement

Nyando Division is located in Kano plains in Kisumu district. It is characterised by black cotton soil suitable for rice cultivation. Most of the roads in this region are not all weather type. Since the region is prone to flooding, these roads are mostly destroyed and hence not suitable for motorised transportation. There are such urban and market centres as Ahero, Korowe and Rabuor along Nairobi-Kisumu road that attract and generate traffic to and from the interior of the rural area.

In Nyando, there is a high demand for both the movement of people and goods. There are passengers travelling to and from the interior from either the market centres or trunk roads as well as goods that needs quick and fast modes of transport. The prevalent modes serving various transport needs are the *matatus* and bicycles apart from walking. It has been realised from the past studies that due to the low income levels in rural areas the majority are unable to own and use the motorised modes in most of their trip purposes. These modes are therefore few in number as compared to the non-motorised ones a case which seems to apply in Nyando.

On the other hand, most of the rural population are not connected to the road networks where motorised modes are accessible. This results to either walking long distances to catch these modes or waiting for them for along period hence causing delays and inconveniences to the travellers. However, despite the fact that bicycles are best suited to the rural areas, little information have been gathered by the researchers to examine the factors and modalities which determine their use.

Due to low motorised modes ownership, long vehicle waiting, poor roads and continued hike in transport fare charges, the majority of the rural residents tend to resort to walking as the alternative mode. In Nyando, a group of off-road bicycle operators along trunk roads transporting passengers and goods emerged some about seven years ago. Since bicycle is a prevalent mode in the region, many people have become used to them and their number have been increasing steadily. Even though this activity has existed for such a period, little study has been dedicated to it to determine the factors encouraging it in the division. This study aimed at finding out the factors encouraging this commercial bicycle passenger and goods transportation and the modalities determining their use amidst other modes in the region.

Apart from the transport role of moving people and goods to and from the interior, off-road bicycle operation seems to have some socio-economic impact in the division. Nyando/Kadibo, like any other rural area, is characterised by unemployment together with low income level of the residents. This is because, agriculture which is the basic source of rural employment, has

greatly reduced due to the population pressure on land hence reducing the farm acreage in the region (Adera,1991; Kenya,1994). Currently a lot of research is being carried out to find ways of alleviating rural poverty and unemployment and how to stop rural to urban migration. The *Ngware-ini* operation which comprise young people can be one of the ways of solving unemployment of the youths in the region and hence curb rural to urban migration and also provide transport services. It was the aim of this study to find out whether *Ngware-ini* operation can offer employment to some of the Nyando/Kadibo residents and if so suggest ways and means of improving the activity. On the other hand, there seem to be no study that has been dedicated on the socio-economic role of non-motorised modes in this area.

Most of the past rural transport studies in Kenya have concentrated on rural roads other than the non-motorised modes (Ocharo,1977; Obiero,1978). Similarly, those that have covered non-motorised modes have mainly focused on other modes apart from bicycles whereby the majority of the studies being in the urban centres and not rural areas (Rukunga,1990; Otieno, 1993; Njenga,1991; Kimani,1990). The other aim of this study was therefore to fill in the gap in knowledge on the type of transport services offered by these modes in the rural Kenya.

Despite the fact that bicycles are best suited to the rural areas, little information have been gathered by the researchers to examine the factors and modalities which determine their use. The aims of the study was to find out the factors encouraging commercial bicycle passenger and goods transportation, modalities

determining their use amidst other modes in the region and if *Ngware-ini* operation can offer employment to some of the Nyando residents and hence suggest ways of improving the activity.

1.1.4 Objectives

The following were the set objectives of the study:

- 1). To investigate factors determining modal choice in the off-road transportation in Nyando division.
- 2). To examine the operation of the bicycles as rural transport modes.
- 3). To assess the level of employment opportunities generated by the *Ngware-ini* operation to the Nyando/Kadibo rural residents.
- 4). To examine the transport needs *Ngware-ini* operators satisfy and the possible problems they face.
- 5). To recommend ways and means of the efficient use of *Ngware-inis* and other non-motorised transport modes in the region.

1.1.5 Hypotheses

These hypotheses were set for the study and their validity were tested by the data acquired from the field:

- 1). H_0 = The mean waiting time for bicycle operation is equal to or greater than the mean waiting time for the *matatus*
 H_1 = The mean waiting time for *Ngware-inis* is less than the mean waiting time for the *matatus*.

- 2). H_0 = The operation of bicycles do not offer any significant direct or indirect employment in Nyando Division.
- H_1 = The operation of bicycles offers significant direct indirect employment in Nyando Division.
- 3). H_0 = The mean monthly income generated from Ngware-ini operation less than or equal to mean monthly income from agricultural produce.
- H_1 = The mean monthly income generated from Ngware-ini operation is higher than the mean monthly income from agricultural produce.
- 4). H_0 There is no significant difference between the number of people transported by the Ngware-inis and the number transported by the matatus.
- H_1 The number of passengers transported by the Ngware-inis is more than the number transported by the matatus.

1.1.6 Justification for the study

The study carried out was prompted by the researchers main observation on the role of bicycles in the region. They are mostly used on both the on farm activities and off farm activities. Similarly, they are used for both commercial and domestic purposes. A chosen mode of transport for a given area is normally determined by the terrain of the area, income levels and its acceptability by the community, availability of attractive modes and the surface conditions. Historically, Nyando/Kadibo is the only region where bicycles have been used compared to other parts of Kisumu district since colonial times. It's terrain also suits the use of bicycles. In terms of the

distribution of incomes in Kisumu district, Nyando/Kadibo is one of the divisions having middle income meaning that a good number of the population in the region can afford to own a bicycle (Kenya, 1994). This implies that, bicycles will still be viable modes in the region. However, in spite of all these qualifications, no study has been dedicated to bicycle till the recent emergence of the *Ngware-ini* operation.

The continued disruption of roads due to floods and poor black cotton soils within Nyando/Kadibo divisions will still discourage the operation of the motorised modes. According to the 1994/96 Kisumu District Development Plan, the existing roads will still have no improvement. For example, out of all the 90% of roads gravelled were in Miwani and Muhoroni Divisions. The lack of maintenance is due to the severe economic condition that Kenya is now facing. It was discovered from the field survey that out of all of the motor graders serving Kisumu District only two were functional while the rest are grounded. Financial constraint was also cited by rural access officer for both Nyando/Kadibo divisions as one of the reasons hindering their routine maintenance of the access roads. This implies that, bicycles, which can use even very narrow and muddy roads and have less frictional effect on roads, are suitable for use in the study area.

The findings of the study will therefore be useful to the government when planning for rural transport system and appropriate modes of transport. The rural population needs appropriate modes in terms of cheapness, fastness and technology

that are accessible to them. However, the previous transport planning approaches have tended to favour motorised transport which was assumed to be the most appropriate but have been approved to be inappropriate in rural areas.

Similarly, the study will be of great importance both to the government and NGOs that are trying to reduce unemployment and immobility of the rural population. In Kisumu District, the annual population growth rate is estimated to be 3.35% with a proportion of 54% in the productive age. This has led to the continued swelling of the labour force. It is envisaged that the only sector that will absorb them is the informal sector and agriculture. It implies therefore that, some of them will also be absorbed in the informal transport as evidenced in Nyando/Kadibo.

Transport researchers will also benefit from the studies since currently, there seems to be less statistical material on the role of these modes in the region and some parts of rural Kenya. Previous studies in Kenya have proved that there is still lack of studies on non-motorised transportation in both urban and rural areas. According to the Kenya government policy, the need for more research in transport with emphasis on local modes during this plan period is clearly defined (Kenya, 1994). It implies therefore that the findings of this study will be of great contribution towards this goal.

1.2.1 Methodology

This section specifically address itself to the methodological procedures of the study which involved, sampling, designing and administering recording and, personal interview

schedules, obtaining information from local authority and central government records, analysis, presentation and interpretation of the collected data and other information gathered from the field.

1.2.2 Methods of data collection

Data was collected by means of field work. This involved first a pilot study to know how the different homesteads are located and the Ngware-inis areas of operation.

To ensure uniformity in the understanding of the questions, questionnaires were administered by the researcher and the trained research assistants. The researcher and the research assistants were working closely together at times for close supervision.

However, interviews were mainly conducted by the researcher. Appointments to interview government officers concerned was made a few days before the interview. Unfilled interview schedule was given to the officers at the same time for him/her to properly study the questions and answer. On the appointment date, the interviews were conducted and answers filled in. This was followed by discussions on the role of bicycles and the general transportation system in the region.

Personal observation was used through out the study to get the visual impression on the role of bicycles and the transport system.

1.2.3 Sources of Data

Primary Data

This involved designing and conducting recording and interview schedules. Questions were designed with an aim of gaining detailed knowledge of bicycles in the region. They were also aimed at acquiring statistical data to be used in the analysis of the role of bicycle in promoting transport efficiency in the area.

Questionnaires were administered to the household heads, and Ngware-ini operators and passengers, and bicycle repairers and natatu operators. While interview schedule to both the local and central government officers.

Secondary data was obtained from the government records and the related literature.

1.2.4 Sampling Procedure

The universe consisted of all the people in the area of study since it is assumed that all use bicycles in one way or another. Nyando/Kadibo divisions have 24 sub-locations with approximately 12,000 households. Out of these sub-locations a sample of eight were selected which is approximately 30% of the sub-locations in the division. This was taken as representative enough for the whole of the divisions. These were Kakola, Tura, Ayweyo, and Wang'anga of Nyando division and Lower Bwanda, Kwakungu, Lela and Kochieng' of Kadibo division (Figure 2.2). These sub-locations were chosen to represent different socio-economic and infrastructural conditions.

Kakola sub-location harbours Ahero township which is the hub

of both economic and transport activities in Nyando division. Tura is opposite Nyando and is characterised by rice-cultivation with access to the Kisumu-Nairobi road but poor roads to the interior. Ayweyo is far from Ahero town where bicycle-operation is concentrated and one of the economic activity is rice cultivation. The sub-location is also prone to flooding and most of its roads are poor with no matatus operating to the interior from the main road. Wang'anga, though bordered by Nairobi to Kisumu road has no clear economic activity and its roads to the interior are not in good condition with mostly lorries and sometimes private vehicles moving in the existing roads. Ngware operation is still very young activity in the region though it is gaining popularity due to lack of other passenger-transport nodes.

Lela is also another sub-location harbouring Korowe market and located along Kisumu. Kochieng' sub-location is also crossed by the Kisumu-Nairobi road and have some urban influence since it bounds Kisumu Municipality. Roads to its interior are similar to the above characterised by pot holes. There are few matatu operating mostly towards Nyang'ande. Lower Bwanda is located in a swampy area and the only road serving it is the class D-one joining Korowe and Nyang'ande. Kwakungu also shares the same characteristics with Lower Bwanda where by in both of them rice and cotton are grown as the chief cash crops.

During the field survey cluster stratified random sampling technique was devised and adopted for use by the researcher according to the clusters(sub-locations). It was discovered from the field that the study area boundary had been changed including

the sub-locational boundaries. Cluster stratified random sampling was found to be convenient since the population from which sample could be drawn was not up to date. Sub-locations were therefore taken as clusters used as sampling units through which elementary units, that is, the households were interviewed.

In this type of sampling, it is a normal practice to take a proportionate sample from each clustered stratum. In the case of this study, a sample of 160 was taken from households with assumption that each of these households are similar in nature. In the field 20 households were randomly selected from each stratum. During the study a list was taken of the possible number of homesteads and then the required number of household chosen randomly from each. This is because most of the families are settled in a homestead headed by the father or eldest son.

Ngware-ini operators were interviewed using the systematic sampling throughout the study area. Since the estimated population was 400 operators, every tenth of the operators was interviewed leading to a total number 40 being interviewed.

A total of 25 bicycle repairers, and 15 passengers were also interviewed randomly. Similarly 6 natatu operators plying on the Ngware-ini routes were also interviewed using systematic random sampling method where the second from the first was interviewed.

A total number of 215 people were interviewed in the study area.

1.2.5 Field Work facilities

A settlement/transport base map of the region was used to help in drawing up a schedule to be followed in visiting the randomly selected households. A camera was also used for taking photographs for illustrating the nature of bicycle operations in the region and transport in general. A computer was used in data analysis and the packages that applied included the Word processing and SPSS.

1.3.0 Methods of data analysis

1.3.1 Procedures of Data Analysis

The collected data was first edited so that the possible omissions and errors corrected. Similarly the wrong entries and the irrelevant answers were also deleted. These were done in order to ascertain the accuracy of the data. This was followed by the preparation of the data structure and the coding of the questionnaire. Finally the coded data was entered into the computer using Statistical Package for the Social Sciences (SPSS) programme.

1.3.2.0: Methods of Analysis

1.3.2.1 Descriptive Analysis

The descriptive analysis mostly helps in studying how variables are distributed. It also helps in summarising a large quantity of collected raw data into a measurable one using quantitative techniques. The methods included percentages, medians and modes. Frequency distribution which shows the number of occurrence of variables in the data set was also applied.

1.3.2.2 Quantitative Analysis

To test the working hypotheses, the main statistical technique used was the X^2 (Chi Square) statistics.

Chi Square(X^2)

The Chi Square test evaluates the probability of obtaining a set of observed frequencies from a population having assumed frequencies. It is used to test the difference between the observed frequency distribution and the expected one. It can also be used in both the one sample case and more than one sample cases.

Steps in Chi Square Test:

- (a) Take the difference between the observed frequency and the expected or computed ($O_1 - E_1$).
- (b) Square the value that is, the difference between the observed and the expected ($(O_1 - E_1)^2$).
- (c) Divide the value in (b) by the expected value for all the categories or classes in the contingency table to get the X^2 statistic.

$$X^2 = \sum_{i=j}^n \frac{(O_1 - E_1)^2}{E}$$

The probability of the X^2 value occurring by chance is then obtained to decide whether the observed and the expected are significantly different. This is found by using the tabulated X^2 statistic at the given level of significance. If the calculated value is higher than or lower than the tabulated then the hypothesis of no significance is rejected at the selected

significance level.

In a two sample case, the analysis of observed frequencies is similar when using the contingency tables. The expected frequencies are first calculated for all the cells of the contingency. The formula:

$$E = \frac{\text{Row totals} \times \text{Column total}}{\text{Overall total}}$$

The formula was used in examining the difference between the number of passengers transported by the matatus and those transported by Ngware-inis. The calculated expected frequencies are the frequencies that would be expected if there were indeed 'no difference' between the attractions and generations of different zones. Every E value takes into account the proportion of trips in each zone.

However, X^2 test has some of its limitations these are that;

- (a) all data used in it must be in frequencies. It can therefore not be applied in interval scale data.
- (b) its contingency table containing the observed frequencies must have at least two columns.
- (c) samples are also assumed to be independent hence cannot be applied in dependant sample cases and,
- (d) it is assumed that sampling is done randomly.

T-test Method

The method is used to test the hypotheses of difference between means. It is based on a t-distribution which is similar

to but flatter than normal distribution. The t-statistic is calculated using sample statistics as means, standard-deviation and number of cases.

When using the technique, the level of significance must be selected which satisfies the analysis. The main ones used are 0.005 (95 per cent confidence) and 0.001(99 per cent confidence). In hypothesis testing using the method, a null hypothesis rejected when the calculated t-value is either greater than or less than the tabulated value.

The steps in t-test are;

1. State both the null and research hypotheses
2. Calculate the value for t-statistic using the chosen sample statistics.
3. Compare the calculated and the tabulated values at the selected level of significance.
4. Reject or accept the null hypothesis.

T-test Formula:

$$t_{N-1} = \frac{\bar{x} - \mu}{\sigma / \sqrt{N}}$$

Where:

\bar{x} = Sample mean time taken by Ngware-inis

μ = Mean time taken by matatus

σ = Sample standard deviation

N = Size of the sample

N-1 = Number of DF appended to t to accommodate the

estimate in the numerator (x) and the estimate in the denominator (σ).

The technique was used in the examination of the difference between the mean Ngware-ini waiting time and the matatu waiting time and also mean monthly income from Ngware-ini operation and mean income from agricultural produce.

1.4.0 Scope and limitation

The study covered the entire population in that area since it is assumed that all use bicycle in one way or the other. Administrative boundary of Nando/Kadibo divisions used here is according to the 1984-1996 Kisumu District development Plan. The sub-location covered were Kakola, Tura, Ayweyo, Wang'anga and Kochogo of Nyando and Lower Bwanda, Kwakungu, Lela and Kochieng' of Kadibo division.

The limitation were the scanty records or statistics on bicycles in the region since there are no proper studies that have been carried out on them. The county council also have no proper record on bicycles in the area. This resulted into the researcher basing the study at individual level which was also too large. This problem was solved by the researcher's knowledge of the study area and adoption of other study methods similar to this that had been used elsewhere.

The other limitation was finance and time which led to the selection of a small sample of 160 in the whole study area. This possibly could affect the randomness and spatial spread of the sample. However, it was overcome by vigorous statistical testes and the clear formulation of conclusion.

1.5.0 Operational Definitions

1. Non-motorised modes:

They are the hand-carts, wheelbarrows, bicycles, and human porterage, animal-carts and walking.

2. Motorised modes:

They are the engine propelled vehicles used for the movement of both people and goods.

3. Transport corridor:

It is used to mean the main tarmacked roads traversing the study area and the generator of traffic to the interior.

3. Transportation:

It is the movement of both people and goods within an area.

4. On farm transport:

It means the movement within the farms when transporting agricultural inputs and outputs.

5. Off farm transport:

It means the movements between farms and market or road side.

CHAPTER TWO
BACKGROUND TO THE STUDY
STUDY AREA

2.0.0 Introduction

The type of transportation system in any area is determined normally by the consideration of such factors as the topography, climatic conditions, human settlements, income levels and sources employment patterns and maintenance capabilities of modes used among others. These information helped in understanding fully the viability of bicycle operations in Nyando and Kadibo Divisions. In summary, this chapter is primarily based on the local and geographic conditions that influence the use of bicycles in the study area.

2.1.0 Geographic Background

Nyando/Kadibo on Kano plains in Kisumu District in Western part of Kenya(Figure 2.1). The divisions cover an area of 436 km² and is bordered by Miwani Division to the north, North Nyakach Division to the south, Kisumu Municipality to the west, Lake Victoria to the south west and Kericho District to the east(Figure 2.2).

2.1.1 Topography and Relief

The divisions lie on the floors of the Rift Valley and have a homogeneous topography(Figure 2.3). The area's altitude rises from approximately 1100m at the lake shore to around 1300m to the

Fig. 2.1 : NYANDO /KADIBO DIVISIONS : REGIONAL CONTEXT.

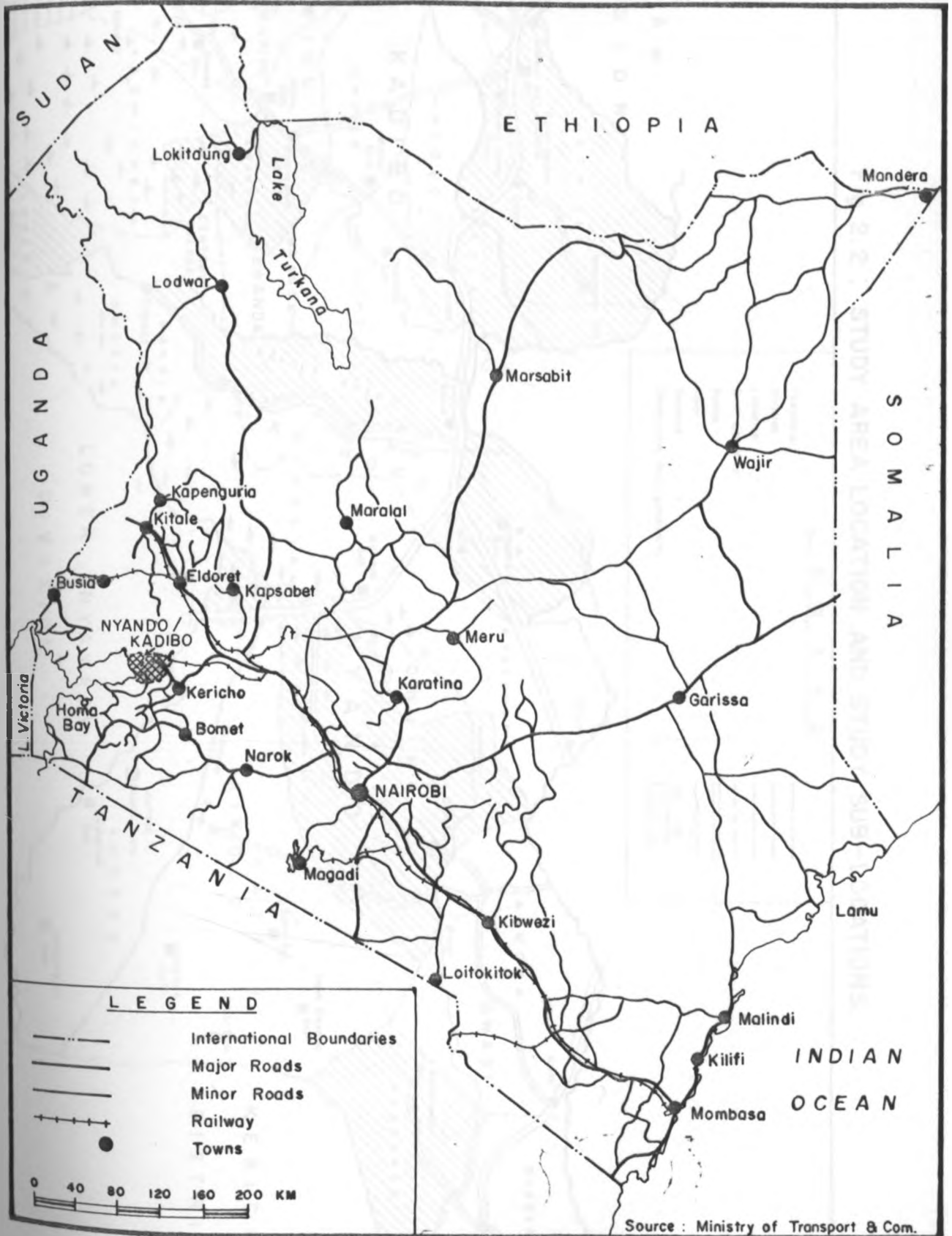


Fig. 2.2 : STUDY AREA LOCATION AND STUDY SUB-LOCATIONS.

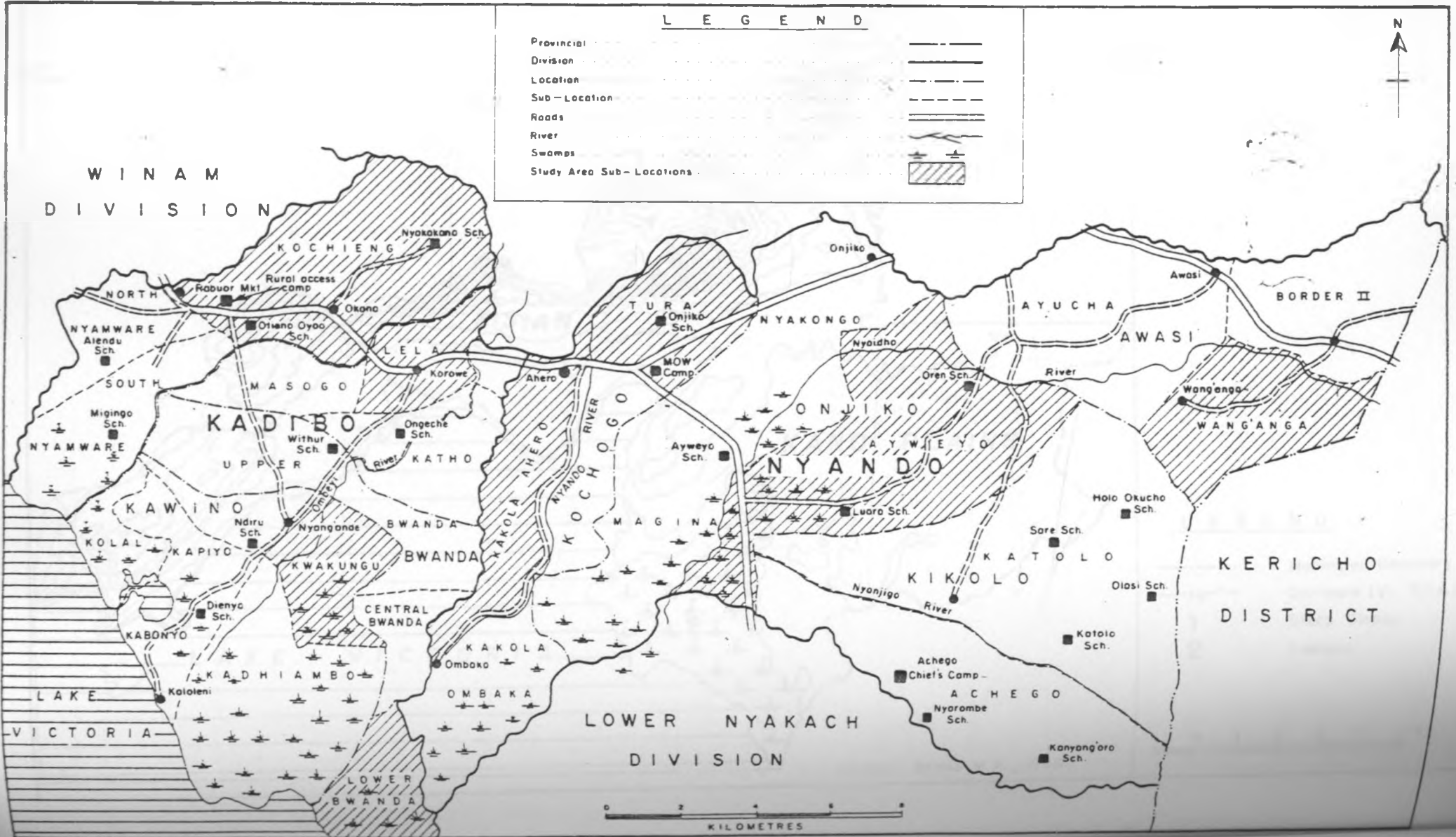
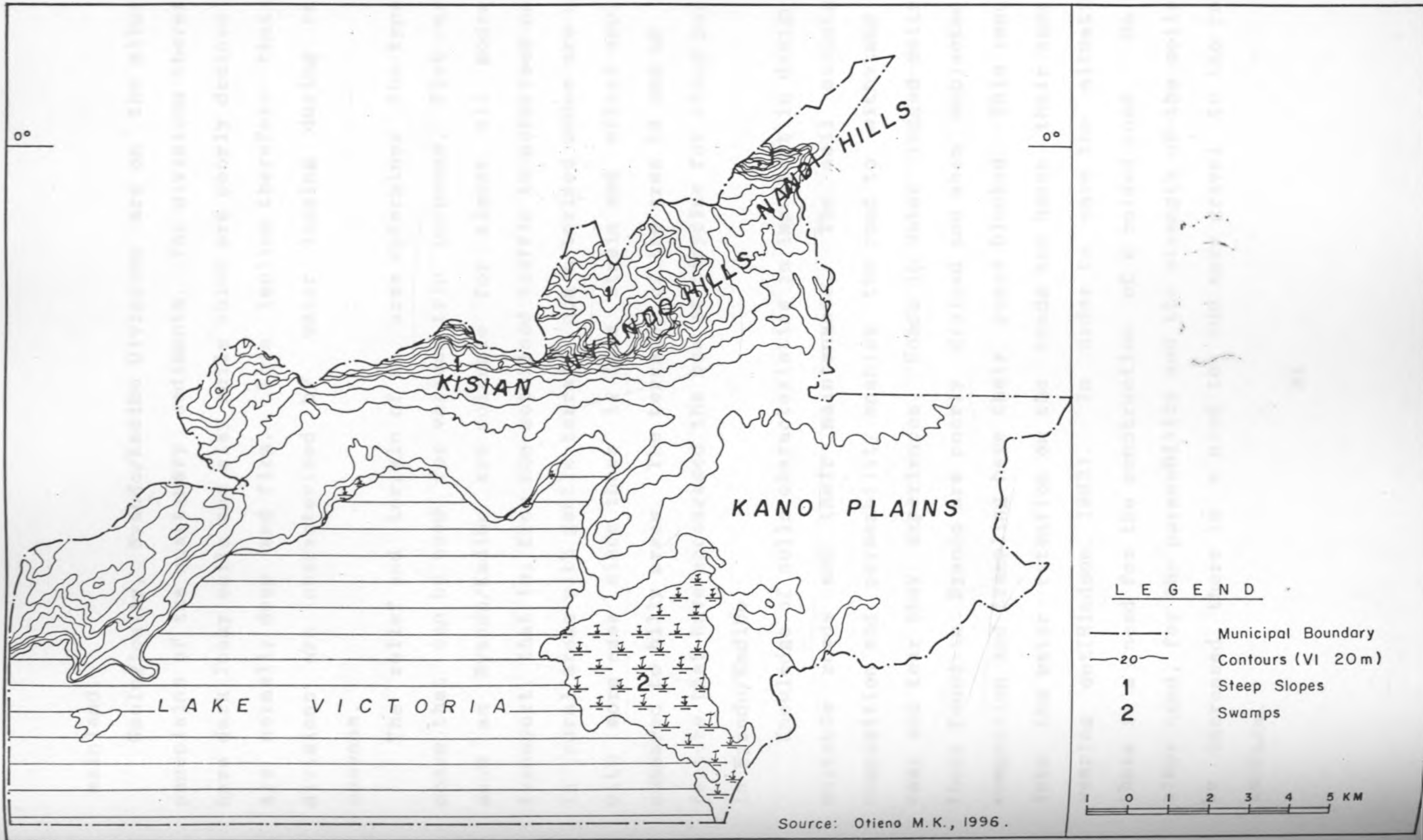


Fig. 2.3 : NYANDO / KADIBO DIVISIONS : TOPOGRAPHY.



mainland.

Geologically, Nyando/Kadibo Divisions are on the alluvial peneplains of the quaternary sediments. The divisions therefore have dark loamy soils and clay soils which are poorly drained and are normally deep and firm. This implies therefore that the divisions are characterised by water logging during rainy seasons.

The relief and terrain of an area determines the type of nodes that can be used for various trip purposes. Flat areas such as Nyando/Kadibo are suitable for almost all nodes of transport, that is, from non-motorised traffic to motorised ones. In rural areas with gentle terrain, non-motorised nodes are used with more ease since there is less strain and effort applied compared to hilly areas. The terrain of the area is one of the factors that have encouraged the use of bicycles for along period in Nyando/Kadibo.

Knowledge of soils characteristics is important in design of suitable roads and their maintenance. The soil structure, composition and permeability enables the road to withstand the wear and tear they experiences. Roads in water logged soils as those found in Nyando are poorly drained and when subjected to compaction and trampling have their pores blocked. This results into the water retention on the roads and hence their ease of wearing out (Hindson, 1983). In order to save the situation, there is a need for the construction of a raised road. On the other hand, for the permeability and the strength of the soils to be increased, there is a need to add more gravel to the roads surface.

Water logged soils mostly make movement by some modes of transport difficult since the vehicles get stuck. However, modes like bicycles, as found out in Nyando/Kadibo, can easily move through the places since they are light in weight as compared to other modes.

2.1.2 Climate

Nyando/Kadibo Divisions fall in Sub-humid region where it receives a mean annual rainfall of 1016mm to 1270mm and a mean annual maximum temperature of approximately 23°C.

Nyando/Kadibo experiences two rainy seasons where long rains starts from April to May while short rains from August to September. The wet spells are short while the dry spells are widely spread.

Owing to the loss of water during a spell of dry weather, clay soils are one of the most dangerous subsoils since soils erosion will be highly encouraged through friction. On the other hand, when it is wet, it easily yields under traffic pressure and to slide and hence it can cause a complete destruction of road structure (Salkied:1953). The amount of rain received is also important in determining the type of road to be constructed. It has been proved that water is one of the main destroyers of a road for it attacks it by saturation from wet conditions in the area, by capillarity attraction and water penetration from roads surface (Salkied:1953) mostly when it comes in sharp storms as experienced in Nyando during the long rains.

The average annual temperature of Nyando/Kadibo portrays that the region is hot. High temperatures normally discourage

people using some modes for example walking and other human powered modes. This was found to be one of the factors encouraging the use of bicycles in Nyando/Kadibo. On the other hand, the long spell of dry season gives the bicycle operators an opportunity of using the bicycles with ease since there is no lots of mud which makes movement difficult.

2.1.3 Drainage

Nyando/Kadibo Divisions are drained by rivers Ombeyi, Nyando, Nyanjigo and Nyaidho (Figure 2.2). There are also some swamps in the region.

The key problem affecting the divisions is an abrupt rise of rivers volumes during rainy seasons leading to overspill on their banks. Since the area is flat, there is a lot of deposition of loads, silting, channel braiding and hence the change of streams courses. The combination of excess discharge from the floods and rivers lead to the destruction of roads and bridges in the region. The destruction are like erosion resulting from too much accumulation of water on the roads due to flatness of the land and sweeping away the bridges (Hindson, 1983).

This explains as to why the divisions will still suffer from lack of motorised modes operation due to the poor roads giving the chance to the non-motorised ones like bicycles which can operate reasonably throughout the seasons and in all situations. The reason being that such modes as the *matatus* sometimes stop their operation during rainy seasons since they cannot cross some parts of the study area. As was observed from

the field, the *Ngware-ini* customers were ready to a light in areas that were swept by floods as bridges and culverts then board their modes after crossing over. However, in order to save the situation in Nyando/Kadibo Divisions, there is a need is to construct roads having surfaces that rise above the water logging level together with better side drains which collects water and takes away from the paths (Agate,1983)

2.2.0 Socio-economic Background

2.2.1 Population

According to the population distribution in Kisumu District, 38.4% are urban based while 61.6% are rural residents mainly occupied in agricultural activities. In the divisional distribution of population, Nyando/Kadibo accommodates 16% of the total population meaning that it is the third division having the largest population in the district (Table 2.1).

There is also variation in population density in the division which ranges from 380 people per square kilometre to 100 per sq kilometre. Such a variation is attributed to both the climatic condition and the terrain of the area. Areas that are prone to flooding have sparse population compared to areas not very much affected by floods. However, the divisions are also still faced with high rate of population increase estimated to be 3.7%. The rapid population increase has led to the reduction of land acreage limiting the opportunity for large scale farming.

Table 2.1 Divisional Population Distribution 1984

Division	% of Total <u>Population</u>	1984
Maseno	19.3	152601
Winam	38.4	303620
Nyando/Kadibo	16.2	128090
Muhoroni/Miwani	10.1	79858
Upper Nyakach	9.5	75114
Lower Nyakach	6.5	51395
Total	100.0	780678

Source: Kisumu District Development Plan 1994/96

The implication of this is that, agriculture which is the main source of rural livelihood is limited in its exploitation to fully support the rural population. The high rate of population also implies that the demand for travel also increases which require that all the available modes should be put in to use to meet the demand.

2.2.2 Agriculture

The main source of employment and livelihood of the people in Nyando/Kadibo is Agriculture. This is justified by the fact that 53% of Kisumu district's population rely on agriculture. The crops grown in the area are cotton, sugar cane, rice, maize, sweet potatoes, cassava, peas and sorghum. Out of these, the cash crops are cotton, rice and sugar cane. In livestock production, the livestock reared are cattle, sheep and goats together with poultry for meat, milk and eggs.

Nyando/Kadibo Divisions is one of the regions growing chief cash crops in Kisumu District as sugar cane cotton and rice.

According to the agro-ecological zonation of Kisumu District, most part of Nyando/Kadibo divisions fall under Cotton zone followed by Sugar cane Zone (Table 2.2).

Table 2.2 Agro-ecological Zones by Division (Sq. Km)

Division	Zones					
	UM ₃	LM ₁	LM ₂	LM ₃	LM ₄	Other
Maseno	-	26	149	236	7	13
Nyando	47	-	52	431	129	8
Winam	-	-	-	38	56	-
Muhoroni	24	6	337	-	-	-

UM₃= Marginal coffee zone

LM₁= Lower Midland Sugar cane Zone

LM₂= Marginal Sugar cane Zone

LM₃= Lower Midland Cotton Zone

LM₄= Marginal Cotton Zone

Other= UM₁(13) & UM₂(8) Coffee and tea Zones

Source: Kisumu District Development Plan 1994/96

However, out of the households growing high value cash crops in the divisions only 6% of the households are engaged in the activity while the remaining fall in the small scale farming group (Table 2.3). This implies that high value cash crop farming do not benefit the majority. The study also further confirmed this fact in that out of the people interviewed both in Nyando and Kadibo divisions 70% are peasant farmers.

On the other hand, the agricultural sector is faced with some problems as overgrazing of most places that now render them unsuitable for cattle rearing and also reduces land potentiality. Land potential for agricultural development is also minimal due to its soils and low rainfall reliability (Bowa, 1987). The short rains for example, are low and scattered for vast period and this

makes crop cultivation difficult. Soils also have moderate fertility and are prone to water logging during rainy seasons while hard in dry seasons. These soil characteristics make cultivation of various crops difficult in the divisions hence few can be cultivated regularly.

Table 2.3 Small-Farm Sector in Kisumu District by divisions

<u>Division</u>	<u>H/hold per Km²</u>	<u>Main food crop produced</u>	<u>Main cash crop</u>	<u>% of household with high value cash crop</u>
Winam	1650	Maize Beans	Coffee Cotton	2
U/Nyakach	320	Maize Beans	Coffee Cotton Rice	8
L/Nyakach	193	Maize Beans	Cotton Rice	13
Maseno	445	Maize Beans	Coffee Cotton	1
Nyando/ Kadibo	290	Maize Beans	Cotton Rice Sugar cane	6
Muhoroni/ Miwani	123	Maize Beans	Coffee Rice Sugar cane	78

Source: Kisumu District Development plan 1994-1996

The divisions are also faced with population pressure on land. It is estimated that the average population density is 290 per km² in some parts with a population growth rate of 3.35%. The rapid population growth has led to land scarcity and hence the reduction of land acreage under agricultural production (Adera, 1991). These factors have proved that even though agriculture is the main source of livelihood in the region, it

can not fully sustain the population economically. This is one of the factors encouraging commercial bicycle operation in that income generated from it supplements the one from farming.

2.2.3 Employment and Incomes

As stated above, the main source of employment in rural parts of Kisumu District is the agricultural sector apart from fishing. It is estimated that by 1993, 53% of the total labour force were either engaged in agriculture or livestock production. However this sector has been loosing since 1986 due to such problems as late payment in the major cash crops as cotton and sugar cane by their main purchasing agencies hence farmers have been forced to look for alternative employment.

In Nyando/Kadibo Divisions where such cash crops as sugar cane, cotton and rice are grown, it has been discovered that most of the labour is more busy during the peak planting and harvesting periods but in off-seasons there is normally a disguised unemployment. The implication of this is that alternative employment sources should be found that can absorb these people during such seasons. The encouragement of bicycle operation can be one of such alternatives.

Fishery is also another active sector that directly offer employment in the study area. A good percentage of the Nyando/Kadibo Divisions was formerly engaged in this activity either through vending or fish peddling. However, the sector has also been reducing in its capacity to offer employment mainly due to lack of storage facilities and hijacking of the business by wealthy groups. A Study of the employment profiles in Kisumu

district reveals that fishing sector only absorbs 7% currently compared to informal sector 17% and agriculture 47.7%(table 2.4).

Table 2.4 Employment Profile in Kisumu District 1983

<u>Profile</u>	<u>1983</u>	<u>Proportion of Labour force</u>
Labour force	380 261	100.00
<u>Agricultural labour</u>		
Small farm holding	181 384	47.70
		1.59
Large farm	6 048	3.71
	14 108	
Migrants seasonal		
<u>Other rural self employment</u>		
Fishing	26 618	7.00
		1.00
Mining and quarrying	3 808	
<u>Wage Employment</u>		
Public sector	57 093	15.00
Private sector		5.00
	19 013	
<u>Urban self employment</u>		
Commercial/Business	7 606	
Informal sector		2.00
	64 644	17.00
Grand total	380 261	100.00

Source: Kisumu District Development Plan 1984-1986

Due to the reduction in the number of labour absorbed in these two key sectors, it is envisaged that the best sector that will save the situation is the up-coming informal sector. It is estimated that with the government incentives, the sector will absorb 20% of the labour in Kisumu District during the current plan period. In Nyando/Kadibo Divisions the total number of licensed informal businesses are only 44(table 2.5). It can be noticed from the table that the non-motorised sector is not

included as one of the informal activities yet there are several licensed bicycle repairers in the region. The other area within the informal sector whose potentiality needs further exploration is the informal transport.

Table 2.5 Type of Informal activities in Nyando/Kadibo

<u>Type of Businesses licensed</u>	<u>Nyando/Kadibo 1992</u>
Posho mills	23
Knitting and tailoring	14
Carpentry and Furniture	1
M.V. Repair (small scale)	-
Barbers and hair saloon	-
Radio, clocks & Watch repair	1
Cobblers	1
Jua Artisans(Welding & Scrap metal)	4
Vegetable dealers	-
Car wash	-
Total	44

Source: Kisumu District Development plan 1994-1996

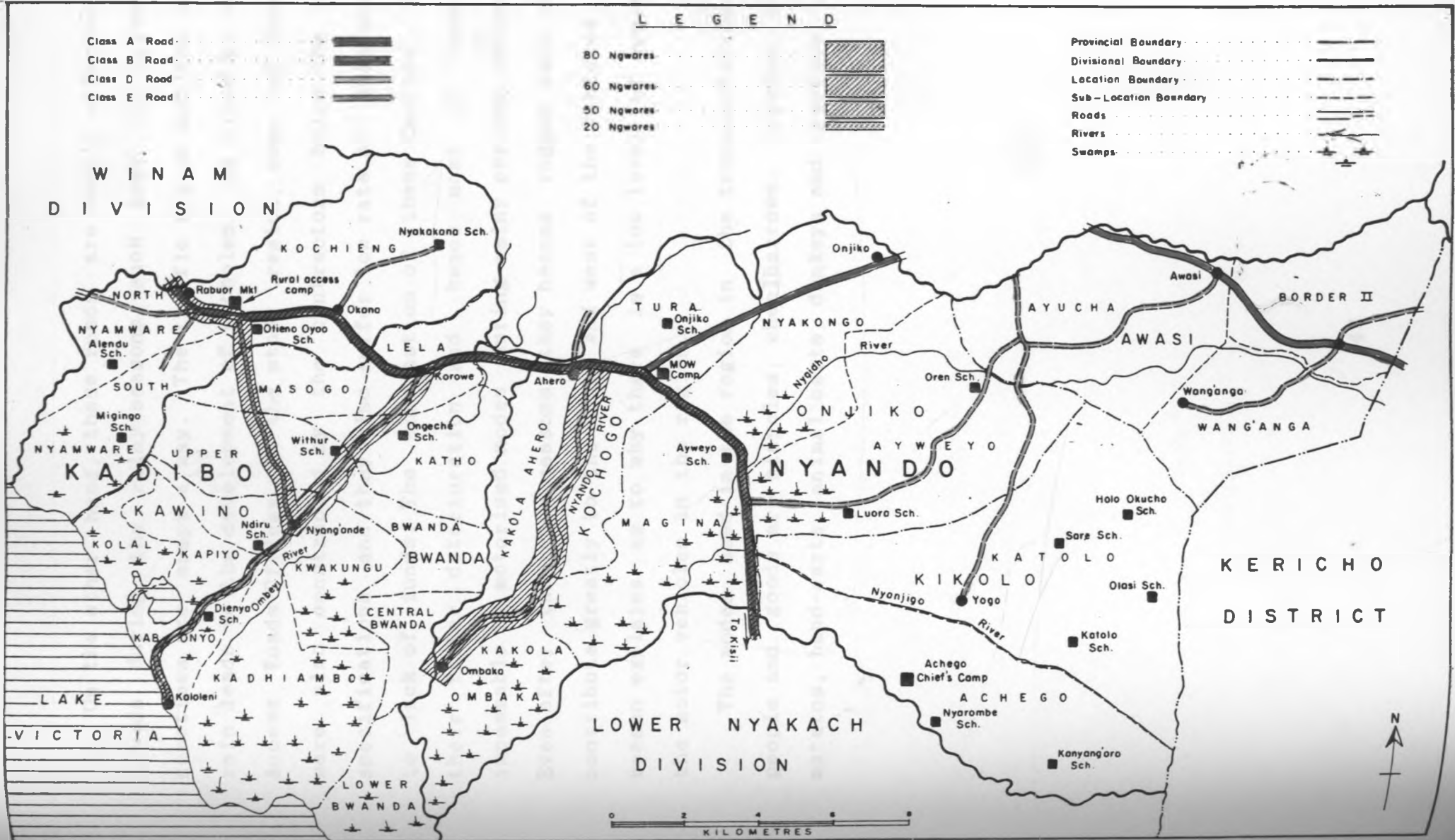
2.3.0 Transportation

The idea of motorable roads came into being in the region with the arrival of motorised modes by late 1940s. The first roads were the paths called "apaya" constructed by the community through the effort of the chiefs. One of these roads is still in use but currently as a class D road in Nyando and Miwani Divisions, that is, the Ahero-Ombeyi-Chiga-Kisumu road. Before these type of roads people used footpaths known as "kor".

It is interesting to note that, since most parts of

Nyando/Kadibo Divisions fall under small holder rice areas, the region is basically served by feeder and access roads of classes D and E. However, there are class A and B roads traversing the divisions, that is, the Kisumu-Nairobi Road and Ahero-Kisii Road respectively. The class E roads are Rabour- Nyang'ande, Korowe-Nyang'ande while Ahero-Ombaka and Ahero-Ombeyi are class D roads(Figure 2.4). The class A road is not mostly used by the Ngware operators because of the fast moving motorised modes exposing them to the danger of accidents and the stiff competition in passenger transport. Their operation is concentrated in both the classes D and E. According to the rural access roads regulation, these roads are planned for 30 motor vehicles per day as opposed to the number currently using them. However the number of motor vehicles currently using them seems to exceed this. Most of these vehicles are tractors and lorries transporting both rice and sugar cane to the processing plants at Ahero, Miwani, Rabuor and Muhoroni.

Fig.2.4 : TRANSPORTATION SYSTEMS IN THE STUDY AREA.



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On the other hand, these roads are mostly affected by the floods during the rainy seasons such that the culverts are sometimes are swept a way. The traffic action and the impact of rain leads to the development of potholes. As cited by the Rural Access Roads Officer in the study region, some of these roads were also constructed by the contractors below the standard specifications and they also suffer low rate of maintenance due to lack of funds. The combination of these factors, leads to their faster deterioration and hence most of them become impassable by motorised modes during rainy periods of the year. Even after the rainy seasons, they become rugged such that they contribute greatly to the tear and wear of the vehicles. -- These reason explains as to why there is a low level of operation of the motor vehicles in the region.

The modes used in the region in the transportation of both people and goods are bicycles, wheelbarrows, lorries, pick ups, matatus, hand-carts, animal carts, donkeys and tractors.

CHAPTER THREE

TRANSPORTATION IN NYANDO/KADIBO DIVISION

3.0.0 Introduction

In transport study it is important to understand the transportation system that is, the type of nodes and roads in a region. The existing road network indicates the level of accessibility of various land uses to the community and the suitable types of modes that can be used on the roads in meeting their transport demands. This chapter examines the road network in Nyando/Kadibo Divisions and the modes generally used in different trip purposes.

3.1.0 Prevalent modes used

In Nyando/Kadibo Divisions, just like any other rural area, experience diverse transport needs as social visits, going to markets, collection of firewood, fetching water, going to farms, travelling to schools and health centres and travelling to main transport corridor among others. These transport needs cannot be met by a single mode of transport. Therefore, the existence of different modes of transport gives the people a wide range of modal choices. The choice of modes for use on the other hand is determined by such factors as accessibility, cost, distance to be travelled, type of goods to be consigned, a mode's uniqueness and suitability.

Within the two divisions the prevalent modes used in meeting the various transport needs are matatus, buses, tractors, bicycles and other forms of NMT.

3.1.1 Matatu and Buses

Buses are used mainly in meeting passenger transport needs in long distance trips. They particularly operate along the transport corridors traversing the Nyando/Kadibo Divisions, that is, Kisumu-Kisii road and Kisumu-Kericho Road(Figure 2.4). Their level of service in the divisions is limited in that they do not directly serve the interior parts due to their route schedules. Virtually there are no buses operating within the divisions in the provision of passenger transport. However, the ones operating along the transport corridors are serviced by matatus and bicycles who transport some of their passengers from the interior to the road side. Similarly buses also beef up bicycle customers who alight from them and would like to have faster travel to the interior(Plate 3.1).

PLATE 3.1 NGWARE-INI OPERATOR COLLECTING PASSENGERS FROM BUSES



Source: Field Survey 1996

The other motorised modes assisting in passenger and light goods transport within the region are the matatus. Their operation is both concentrated along the routes to the interior and the transport corridors. This is because some of them transport people from the interior to other towns like Kisumu, Miwani and Muhoroni among others. They mostly operate along such roads as Ahero-Ombaka, Ahero to Ombeyi, Korowe to Nyang'ande, Rabour-Nyang'ande-Ndiru(Figure 2.4). Apart from the passenger and goods transport, they are also in rare occasions hired to offer such services as ambulance and farm produce transport. However, like the buses they are limited in their operations due to the poor condition of the roads in the division. As pointed out above, the roads in this region are destroyed due to floods and the operation of such heavy modes as the tractors and trucks during the harvesting periods. The matatus cannot use them fully throughout the year because some of their sections are impassable during rainy seasons and after the rains the potholes left contributes greatly in the wreckage of the vehicles.

The matatus are also associated with delays caused by long waiting for passengers and fare counting/totalling by the agents. In some places they are quite unpredictable in their routes of operation in that they frequently breakdown due to their irregular maintenance. These reasons lead to most of the Nyando residents to choose either to walk or board bicycles. Their problem of delays was revealed by the study results in that 100% of the matatu operators interviewed said that they normally experience delays mostly on non-market days. When the matatu operators were asked the reasons for their delays, majority cited

Ngware-ini operators(66.7%) while others said less passengers(33.3%).

3.1.2 Tractors and Pick-ups

Tractors were observed to be many in the region as compared to the pick-ups. The services they offer are mainly on goods movement particularly in the transportation of rice and sugar cane. The pick-ups are mostly used on private basis by those having large scale businesses who use them for the shop merchandise transport. Both the tractors and pick-ups mostly operate along such roads as Ahero-Ombeyi, Korowe-Nyang'ande and Ombaka-Ahero(figure 2.4). These roads serve the regions characterised by rice and sugar cane cultivation.

In terms of modes ownership, it was discovered from the field data that the minority of Nyando/Kadibo residents own tractors (3.1%) and pick-ups (2.5%) (table 3.1).

Table 3. 1 Modes Ownership in Nyando/Kadibo

<u>Mode Type</u>	<u>Frequency</u>	<u>Percentage</u>
Bicycle	98	61.2
Handcarts	12	7.6
Wheelbarrow	25	15.6
Pick-ups	4	2.5
Car	3	1.9
Tractors	5	3.1
Others	24	15.0
Total	171	106.9

Source: Field Survey 1986

Most of the tractors are owned by the Ahero Irrigation Board, Miwani Sugar Company and Muhoroni Sugar Company. However, it can be noted that the total percentage is more than 100 because of

the multiple mode ownership by the residents.

3.1.3 Bicycle mode

The prevalent modes out of the ones used in Nyando/Kadibo divisions (a part from walking) are bicycles (Table 3.1). The study revealed that bicycles started being in use as early as 1940s in the region. By then it was one of the prestigious modes used mainly by chiefs and wealthy people. Before its emergence, chiefs were carried by members of the community while the wealthy people used bulls mostly for their journey trips. The emergence of the bicycles was therefore a relief to the chief's aides. In case of the bicycles' breakdown, it was carried by human portage to Kisumu for repair by the Indian bicycle repairers who had the technological know how on the mode.

For along period, the bicycle mode, has been cherished by the people because of its suitability in socialization, for example, two people could ride on one bicycle or different ones and still share a conversation as they travel. There is also a general belief that the mode makes people strong. The other advantages were ease of operation and use due to the terrain and its technology and in the transportation of light goods as luggage and agricultural produce. Because of the high value they have placed on the bicycles, it has been one of the prioritised items of the resident's to purchase incase of financial boom up to present time. This explains as to why bicycle ownership and use in this region has continued to rise.

Bicycles offer a wide range service both on passenger and goods transport. It is also currently used as a public transport

mode in the region in offering these services.

3.1.4 Bicycle as Private mode

The majority of the households interviewed own bicycles (58.1%). It is the second mode mostly to walking used in various trip purposes as market, school, hospital, water transport, farm and social/roadside(table 3.2). The table shows the level of use of various modes in different trip purposes.

Majority use it for market trips (45.6), followed by main road/home trips (42.9%). The reasons given for such use was that these activities are located far a way from most of the people and hence bicycles are the faster mode that can be used to reach them. Some people use it as a mode of transport to the hospitals and health centres in search of medical services. However, bicycles were found to be less used in water transport (10.2%), school trips (28.8%) and farm trips (29.7). This is because water is mostly transported on head

Table 3.2 Level of use of various modes in different trip purposes.

Mode	Trip purpose(%)					
	Road/ Home	Market	School	River	Hospital	Farm
Bicycle	42.9	45.6	28.8	10.2	35.4	29.7
Walking	52.7	48.6	71.2	84.3	54.4	63.5
Pick-up	2.0	3.4	-	-	6.1	1.4
Car	1.4	0.7	-	-	1.4	1.4
W/barrow	-	-	-	2.1	-	4.0
Others	2.0	2.1	-	3.4	4.1	-
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source:Field Survey 1996

while school children are used to walking on foot. In terms of farm transport, bicycle activity rises with the planting and harvesting periods. However, few use them in their daily farm trips. One of the reasons is that most of the farms are within walking distances of approximately 10-100 metres from homes.

The bicycle owners were also found to use the modes for about 10 times per day where it is mostly used by the head of the households, that is the farmer.

3.1.5 Bicycle as a Public Mode of Transport

As public modes of transport bicycles are used as commercial goods and passenger transport modes, that is, the *ngware-ini*.

This activity started with goods transportation from homes to markets and the nearby towns as Kisumu and Miwani either by the traders or hired operators. Goods transported were charcoal, and fish. Milk vendors, fish mongers and charcoal sellers and burners used it in the sale of these commodities in the surrounding towns and markets. Later, after rice cultivation had been started, small scale rice traders also started using them since they were considered cheaper and accessible. They could also reach some of the rice paddies where motorised modes could not reach.

The idea of bicycle passenger transportation started in the mid 1980s. The operators borrowed the idea from Uganda where the "boda boda" had started operating. The activity was later encouraged by the transportation problems experienced in the study area as lack of adequate motorised modes of transport due

to poor roads and low motorised modes ownership(table 3.1).

The operation started along Ahero-Riat road (a distance of around 6 km) where the operators were charging between Ksh.2 to Ksh.3 (Figure 3.1). By then many despised these modes and only few could use them since some people considered them inferior to motorised modes while others considered the activity to be "strange" since no one could think of bicycles being used in commercial passenger transport. However, with time people started seeing their importance as those using them could reach their destinations much faster than those waiting for the matatus or the ones who decides to walk.

Currently many prefer to use the *ngware-inis* and they are giving the matatus stiff competition on the routes they are operating on. They also offer ambulance, taxi and goods transport services a part from the normal passenger transportation. The operation also contributes to employment generation and income enhancement in the region. The activity is spreading very fast to other divisions including parts of Kisumu town and Nyakach where they are dominating on some roads.

3.2.0 Other forms of NMT

Various NMTs are also used in Nyando/Kadibo divisions in the transportation of goods and passengers. These include animal carts and sledges, donkeys, canoes, hand-carts and wheel barrows.

Animal carts and sledges, wheelbarrows and hand-carts are basically used in the transportation of goods including farm produce and in-puts, water, firewood and some construction

materials. However hand-carts and wheelbarrows were found to be prevalent in the market centres along the transport corridor as Ahero, Korowe and Rabuor(Figure 2.4). In these centres, they are hired by the businessmen in the transportation of their goods from the road side to the market centre and vice versa on market days. In Ahero, for example, they are also used in the transportation of rice from the stores to the rice milling machines by the businessmen, and in water transportation by the water vendors.

Canoes play a double role of passenger and goods transport between beaches along the lake. Goods transported are basically luggages and fish for sale. Though their operation is limited along the beaches, they also beef up transport for the Ngware-ini operators transporting fish and passengers from these sites to the main transport corridors.

CHAPTER FOUR

OPERATION OF NGWARE-INIS IN NYANDO/KADIBO DIVISIONS

4.0.0 Introduction

The study covered Ngware-ini operators within Nyando/Kadibo Divisions. In the study, it was found out that the operators are registered and there are both part-time and full time ones. Some of these operators were also found to be either owner-operators or non-owner operators. They were also found to be transporting both passengers and goods between their origins and destinations.

4.1.0 Characteristics of Operators

4.1.1 Operators identification

Ngware-ini operation was first an open business whereby anybody could just go with his bicycle to one of the stages and starts operation. However, it was later discovered that there were some operators who were not genuine, that is, they could rob passengers/clients on the way or disappear with their goods if sent to deliver some where. This discovery led to the formation of the operators association and their subsequent registration with the authorities. The association takes a record of the operator's identity card number and a registration fee of Ksh.20 together with the route of operation. The operator is then given a registration number in line with his area of operation, for example, those operating within Kadibo are given such initials as "KDB 123" possibly with the bicycle's name given by the operator as "TEK TE" or any other. This action has greatly encouraged

people to trust the operators and have eradicated robbing or theft of the customers. However, the associations are characterised by wrangles and were found to be dormant.

By the time this study was being conducted, it was discovered that the total number of registered operators were around 400 in the study area. However, the association was discovered to be weak mainly due to a number of misunderstandings between the members.

4.1.2 Operators typology

Ngware-ini operators comprise both part time and full time operators. This classification adopted for the study, was based on the economic activities carried out by the operators where those who did not have any other economic activity apart from bicycle operation were taken as the full-time operators while those who had were classified as part-time operators (Table 4.1). The study revealed that 53% of the operators were full-time while 47% were part-time

Table 4.1 Types of Operators

Type	Frequency	Percentage(%)
Full-time operators	21	53
Part-time operators	19	47
Total	40	100

Source: Field Survey, 1995

Full-time operators were those who have taken the job as their profession. They include those who had looked for

employment in other urban centres and have either failed to get one or were stopped from their duties, and those who had migrated to such urban centres as Ahero mainly to operate the bicycles as a form of employment. The part-time operators were either those who had started other businesses or sugar cane and rice farming through bicycle operation. Others include students and employees elsewhere who have come back home for their holidays and have decided to carry out the operation to meet their daily financial needs.

The hours of business starting and closure for these operators were found to be different. Full-time operators start their business between 6.00am and 7.00am while part-time operators start between 10.00am to 11.00am. Therefore the full-time operators start much earlier than the part-time ones. Table 4.2 shows that 45% of the operators start their business between 6.00am and 7.00am while 35% start their business between 10.00am and 11.00am. The remaining 20% were either full-time operators who sometimes start their business late or the part-time operators who starts early. The operation closure time was also found to differ where 60% closed their business between 6.00pm to 7.00pm, 27% close between 4.00pm and 5.00pm while 13% closed between 8.00pm to 9.00pm.

Operators starting their business from 6.00am or earlier were discovered to play very important role to particular type of clients. These include business people from the interior who wants to reach markets either near and far early enough or those people working in such places as Kisumu who want to report to their offices in time. These people use the bicycles in

Table 4.2 Operators business hours

<u>START</u>			<u>CLOSE</u>		
<u>Time</u>	<u>Frequency</u>	<u>Percent</u>	<u>Time</u>	<u>Frequency</u>	<u>Percent</u>
6.00- 7.00pm	18	45	4.00- 5.00pm	11	27
8.00- 9.00pm	8	20	6.00- 7.00pm	24	60
10.00- 11.00pm	14	35	8.00- 9.00pm	5	13
Total	40	100	Total	40	100

Source: Field Survey 1995

transporting them to the roadside where they can board motor vehicles to their final destinations. Some of them were found to negotiate with the operators on a monthly payment basis. Though some of these people have their bicycles, they find Ngware-inis to be convenient in that they do not have to look for safe place to leave their bicycles.

Those operators closing early were found to be part-time operators who are going back to close their businesses or those who have got their needed pocket monies such as students on holidays. The operators closing between 8.00pm to 9.00pm were discovered to be full time ones who volunteer to wait for the late arrivals. At such hours, it was found out from the field survey that they normally charge double fare due to the possible risk involved. The passengers find them convenient in that they provide them security and fast travel to their destinations, that is, to their homes.

4.1.3 Education, Age and Gender

The survey findings revealed that 100% of the *Ngware-ini* operators were men. Women were found not to be engaged in the operation mainly because the exercise is tedious and at the same time passengers doubt their steadiness. On the other hand, they have several domestic duties at home such that they do not have time to operate bicycles. However, they were found to be indirectly engaged in the activity in that they own food kiosks serving the operators at their usual stages. A survey at Ahero stage revealed that out of the food kiosks located there, 70% were operated by women. Some of the women operating these kiosks at the stages were discovered to be the wives of some of the bicycle operators who had used the money to start such businesses. However, even though women were found not to be operating *Ngware-inis*, they normally use personal bicycles in market, social and farm trips (Plate 4.1).

In the examination of the operators age, most of them were found to be still young with their ages ranging from 15 to 48 years with an average age of 26 years. Approximately 73% of the operators were found to be between 16 to 30 years. However, when their ages were compared to the bicycle repairers and *matatu* operators, the mean age of *matatu* operators and bicycle repairers were found to be 32 years and 38 years respectively showing that both were higher than the bicycle operators. Age was an important factor in the operation in that most people do not like to be transported by very old people due to respect and very young people because they do not trust their steadiness. In

terms of employment, it indicated that the activity absorbs the rural active group.

PLATE 4.1 A WOMAN PUSHING A BICYCLE IN AHERO TOWNSHIP



Source: Field Survey 1996

In terms of operators' level of education, it was discovered that all of the operators had either attained primary or secondary education. Out of the total number interviewed, 70% and 30% had primary and secondary education respectively. This imply that the operators have the ability to fully plan on how they can improve their operation within the study area and promote the operation as part of rural development activity that can offer employment to other young people in the region.

4.1.4 Bicycle Ownership

The number of operator-owners and non-owners were found to be the same that is both were found to be 50% each (table 4.3). This characteristic deviates from the normal mode ownership where the owner operators tend to be higher than the non-owner operators. For the operators owning bicycles it was discovered that 65% purchased their modes through personal savings while 5% hire purchase, 20% farm produce and 15% got their through personal savings. Out of the non-owner operators it was also found out that 65% hired the modes while 35% were given the bicycles by their relatives.

Table 4.3. Ngware-ini Operators' Mode Ownership

<u>Ownership</u>	<u>%</u>	<u>Acquisition System</u>	<u>Percentage</u>
Owner-operator	50	Personal Savings	65
		Family gift	15
		Hire Purchase	5
		Farm produce	20
Total	50		100
Non-Owner operator	50	Given by relative	35
		Hired	65
Total	100		100

Source: Field Survey 1996

When the owner-operators were asked on the number of bicycles they own, 52% said that they have two bicycles, 40% had one while 18% had three. Out of the operators owning more than one bicycle interviewed, 45% said the other bicycle(s) serve domestic transport needs, 25% said hiring out and 35% used it in

passenger transport if the other breaks down. The other bicycle therefore acts as a security/reserve for the normally used one so that operation is not interrupted at any time.

The non-owner operators given bicycles by their relatives were mostly young people who are either on their normal vacations or week-end rest. A further inquiry revealed that they were mostly given bicycles by their fathers to assist them get their pocket money or earn bread for the family. Though the engagement formally lured young students to abscond classes but this was curbed through the cooperation of the local administration, teachers and parents. In the case of those hiring, the charges were paid on a daily basis at an average rate of Ksh.50. The repair work is mainly borne by the operator.

4.1.5 Period of business and the operators previous and other occupation

The average period of the business was found to be four years but the ages were ranging from 1 month to 6 years. Approximately 68% of the operators were four years and below while 32 were five years and above (table 4.4). The fact that the average time of operation is four years and a larger percentage is in the older group implies that the activity is established and have the potential of offering employment.

In the examination of the operators occupational characteristics, the study also revealed that, 60% had looked for employment in other Kenyan towns whereby 72% of them managed to get a job while 28% did not get. It was found out from the study that, out of the number who got jobs, they were employed as

clerks(14%), messengers(20%), labourers(55%) and

Table 4.4 Period of business operation

<u>Age groups</u>	<u>Frequency</u>	<u>Percentage(%)</u>
1 - 11 months	6	15
1 - 2 years	5	13
3 - 4 years	16	40
5 years and above	13	32
Total	40	100

* Mean operation period= 4 years

Source:Field survey 1985

supervisors(11%). They gave the reasons for leaving their jobs as low wage(50%), tedious job(17%), sacked(22%) and firm closure(11%).

The knowledge of the previous occupation is important in understanding the reasons for starting the operation and bicycle ownership. The fact that 72% had got jobs formerly, explains the reasons as to why the majority are operator-owners. Since, a bicycle is a very important mode used in meeting various transport needs in the region, it has been a tradition in the study area that a working person must first try to purchase a bicycle even before the beginning of Ngware operation. In the examination of the bicycle acquisition system 60% of the operators said that they acquired their bicycles through personal savings. The reasons for leaving the job supports the reasons given as to why majority in the business year are in the old group. Since 50% left their jobs due to low pay, they have found Ngware-ini operation to be more profitable than the other forms of employment they were engaged in formerly.

In addition to bicycle operation, the study also revealed that the operators had other occupations as farming and business. The majority which account for 25% are engaged more particularly in farming of cotton, sugar and rice as cash crops, while 22% are engaged in business which are mostly operated by their wives. The remaining 57% said that they do not have any other occupation. As a rural area activity, this could be an idea borrowed from small holder farmers who normally diversify their strategy against risks (Ngau,1995) The operators said that they have to engage in these activities in order to bank for the bicycles and at the same time maintain financial stability. Besides this, some have the intention of expanding these occupation to a level of being able to start their hire-acquire shops where people can hire bicycles for various uses.

4.2.0 Operational framework

4.2.1 Areas of operation

The key origins of the operators within the study area were found to be Ahero, Rabuor and Korowe all of which these area market centres located along Kisumu-Nairobi Road. Key destinations identified were Ombaka, Nyang'ande, Ndiru, Kaloleni, Kaluore, and Ombeyi which is beyond the study area boundary. The origins of these operators were found to be specific while their destinations were found to be not specific. These origins are established mainly because of the traffic generated to the interior either from the market centres or from the motorised nodes bus parks operating along Kisumu-Nairobi road. The destinations mentioned are ones used by them in setting their

fare charge structure. Otherwise, they normally transport people even to some parts interior far away from these destinations depending on a passenger's needs.

4.2.2 Customer Identification and characteristics

The operators have different types of customers as general passengers, business people, farmers and employees. Ngware-ini operation is still in the process of proper organization, so they do not have formalised way of identifying customers. However, since the activity is widely known within the study area, it is the customers who mostly look around for them incase transport need arises. The characteristics of the operators in terms of their modes and stages make it easier for the customers to identify them. They are normally stationed next to the existing matatu and bus stages along their routes of operation where customers can easily locate them. On the same note, their seats which differentiates them from other normal bicycles, are well cushioned that customers can easily notice. They also have foot-rests wielded on the wheel spokes and number plates written on the mudguards.

It is important to note also that because of the good relationship they have developed with their customers, people normally go for them and in some cases, they are notified by their colleagues incase there are passengers to be picked from some distant places.

The study also revealed that the most of the customers use the modes because they are fast and accessible(73.3%) while (26.7%) use them because they can reach their door steps. The

fastness of the nodes was attributed to the fact that they are single passenger nodes which do not waste time in waiting for more passengers. The nodes are accessible to the customers in that they are around in their stages in all times of need. The customers who they transport to the doorsteps are either those who board them on hire basis or business people who send for their goods to be transported to and from home.

In terms of the nodes frequency of use by the customers, it was found out that 40% use them daily, 33.4% three to four times a week and 26.6% after a week or more. This implies that the majority of their customers use them daily on their various transport needs. The daily use of these nodes by the majority signifies that the activity is well established and the Ngware-ini operators offers very important services to these people.

A further examination of the customers on the possible problems experienced when using the Ngware-inis revealed that 40% have not experienced a problem, 20% said poor and rough roads, 10% rain and hot sun, 5% high speed while 35% said hard seats.

According to the household interviews, the study revealed that 59.4% had used the Ngware-inis while 40.6% had not. For those who had not used the nodes, 46.6% had their own nodes, 26.1% fear and have low opinion on them while 25.5% had not had the opportunity to use them. Those who fear and have low opinion on them gave their reasons about the nodes as dangerous and not suitable for transportation on taxi basis. Majority of these were women who fear using them in that they sometimes throw them off the seats and fall down when moving at high speed. The problem was found to be mostly caused by the sitting style of

women on the modes since the carriers are not well designed for their comfortable sitting (Plate 4.2). While those who had not had the opportunity were found to be very old people who are mostly in their homes and the people living in areas where the activity has not been well established as the western side of Nyando as Wang'anga and Ayweyo sub-locations.

(figure 3.1).

4.2.3 - Pricing/Fare charges

The operators fare charges are based on the former matatu charges on their routes of operation. However, they differ with the matatus in goods transport charges which depends mostly on the weight of the goods and distance. For example by the time of this study, they were found to charge one sack of rice and sugar at Ksh. 70 and Ksh 50 respectively for a distance of between 3km to 4km.

PLATE 4.2 A WOMAN TRANSPORTED BY NGWARE-INI OPERATOR



Source: Field Survey 1996

The matatus also use same parameters in the charges but charge less amount as compared to the bicycles. However, people prefer bicycle to matatus because they are prevalent and accessible while matatu operators do not like transporting many goods for it wrecks their vehicles.

The transport fare charge of both matatu and bicycle operators for a distance of between 8km to 10km is the same, that is Ksh. 20. However, the fare charge is some times determined by the prevailing conditions and time of the day. When there are few customers, the bicycle operators sometimes reduce their charges depending on the negotiation between them and the customers. On the other hand, during rainy seasons, fare can sometimes rise by Ksh. 5 when it rains but still this can be reduced depending on the negotiations. After 7.30pm, fare charges normally doubles since there are few bicycle and matatu operators. The Ngware-ini operators, therefore charges taxi rates and risk costs at such hours. The fare charge also varies with the nature of a trip. In cases where the operators transport their passengers on a taxi basis, they normally charge the normal fare to and from the destination together with the waiting charge. The waiting charge is mostly a double of the one full trip charge.

However, it can be noted that the operation of bicycles have played an important role in the control of transport fare charge on their routes of operation. Before the advent of the activity, the matatus used to increase fare charges by around Ksh. 5 after every six months. However, since the beginning of Ngware-ini operation in these divisions, the existing fare charge has

remained in use for the past one and a half years on their routes of operation.

4.2.4 Traffic build-up

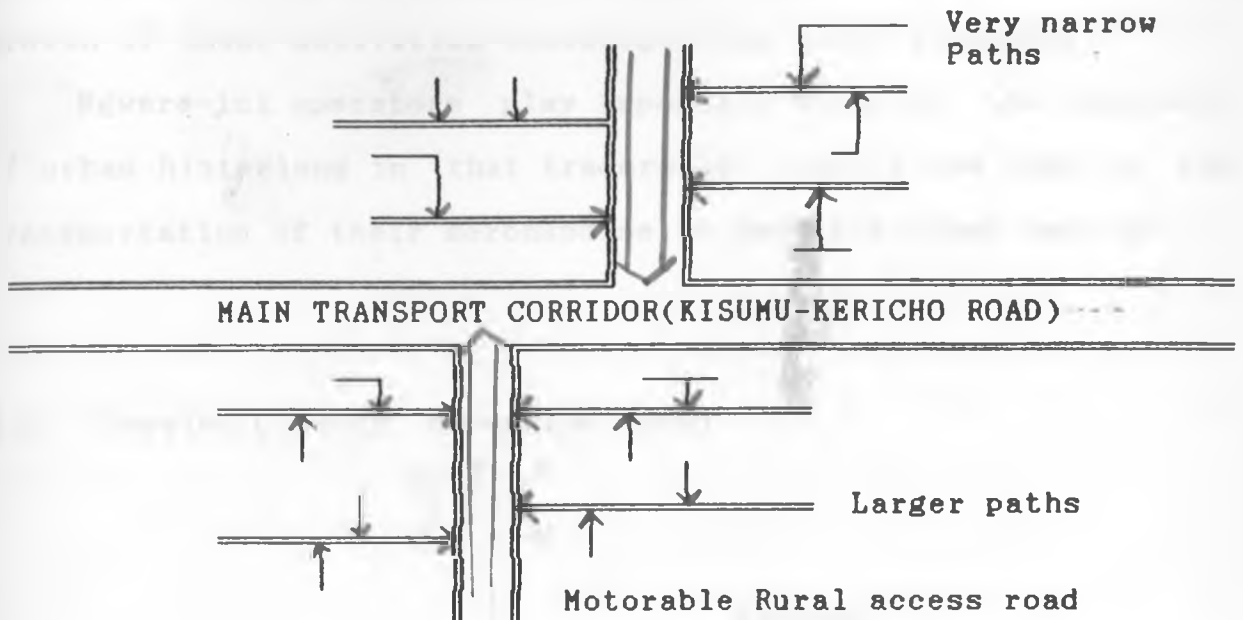
Ngware-ini operators play an important role in the provision of transport services within the study area. In terms of their movement characteristics, their trips were discovered to end and originate in the interior parts of the divisions that the motorised modes cannot manage to reach. This is because they can manage to manoeuvre their ways even to areas having very narrow footpaths when transporting goods and passengers. They therefore collect traffic from these areas to the main roads and transport corridors where long distance travellers board other modes of transport as matatus and buses.

Figure 4.1 illustrates how the Ngware-inis assist in the traffic build-up along the motorable rural access roads and the main transport corridors. They collect long distance travellers mostly using the very narrow footpaths through the larger paths then to the motorable rural access roads. From the access roads, some people decide to walk or board matatus to the final destinations. Since the matatus are scarce on these routes, Ngware-inis contributes greatly in the transportation of the long distance travellers to the main transport corridors where they can either board matatus or buses to the final destination.

In this process of their operation they assist in building up traffic for motorised modes and promoting their business. As pointed out above it has been noted that the motorised modes such as buses can only operate in their routes if they can get maximum

business that can maximize their profit.

Figure 4.1 Traffic build up model



Source: Researcher:1996

This on the other hand implies that the operation of Ngware-ini assist in the sustainability of the operation of these nodes at a certain level. In the process of transporting people from the interior to the roadside, they also reduce the strain in walking long distances and travel time to catch a bus for their users.

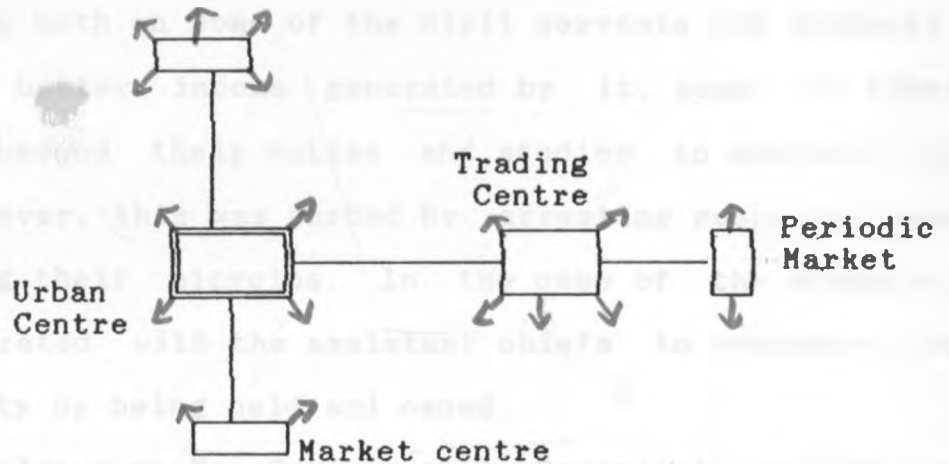
4.2.5 Service Centres Growth and Development

The Ngware-ini traffic were found to mostly originate from the existing urban and trading centres located along the main transport corridors as Ahero, Korowe, and Rabour. Similarly, in the interior, their trips sometimes end in some market centres as Nyang'ande, Ombaka, and Ndiru (Figure 4.2). Most of the economic activities serving the local community as shops are located in

these centres. It is a well known fact that one of the determinant factors for the location and expansion of such activities is the efficient transport network and services. The growth of these activities encourages the urban expansion.

Ngware-ini operators play important roles in the expansion of urban hinterland in that traders can easily use them in the transportation of their merchandise to and from these centres.

4.2 Service Centres' expansion model



Source: Researcher: 1996

This promotes such businesses as bread distribution from distribution centres which serves the hinterland. The operators transport these products from key centres as Ahero and Rabuor to smaller ones as Korowe and in the process faster sales and business expansion leads to the attraction of more business to these places.

4.2.7 Relationship with other institutions

Ngware-ini operation is an activity licensed by the local administration. Most of them operate under their umbrella association registered with the Ministry of Culture and Social Services through their chiefs. The names and number of operators are also in the local police post/stations records. This action has greatly reduced the possibility of bicycle thefts and robbery of customers' goods.

The local administration have played an important role in streamlining their operations. The beginning of the activity had negative effects both on some of the civil servants and students. Because of the better income generated by it, some of these people could abscond their duties and studies to operate the business. However, this was curbed by arresting suspected ones and confiscating their bicycles. In the case of the students, parents collaborated with the assistant chiefs to restrain them from the activity by being held and caned.

There are also some Non-Governmental Organizations(NGOs) as Intermediate Technology Development Group (ITDG) and Kisumu Innovation Centre-Kenya (KICK) based in Kisumu that are currently in the process of promoting the activity in the region. The NGOs are engaged in the improvement of bicycle models that can be suitable for the transportation of goods, passengers and patients. These include the extended bicycles and the ambulances (Plate 4.2). The move will enhance the activity in that the new models can last long and carry more goods and passengers. On the other hand they are also encouraging the sustainability of the Ngware-ini operation by training the informal sector artisans on

the production of some of the bicycle parts.

PLATE 4.3 BICYCLE AMBULANCE TRAILER DEVELOPED BY ITDG



Source: ITDG, Kenya 1996

4.2.8 Sustainability of the Ngware-ini operation

The sustainability of an activity such as the operation and use of a mode of transport usually depends on its acceptability, affordability and the technical ability of the people using it. Ngware-ini operation can be a sustainable activity in Nyando/Kadibo divisions.

Out of the households interviewed (76.3%) said that the activity is a viable one. The reasons given by the residents were that it has reduced their travel time and inconveniences, and young people have been employed in the business hence it has

reduced theft and over dependency in the area.

On the other hand, out of the operators interviewed, 77% still want to continue while 33% do not want to. Those who want to continue, consider it as a better paying activity (Table 4.5), income booster and a source of employment. However, there are also some who want to buy their own bicycles through the activity since a bicycle is a cherished mode in the area and can generate income. The small scale business community also view it as important activity for it reduces their transportation costs.

Table 4.5 Ngware-ini operators and business future

<u>Reasons</u>	<u>Frequency</u>	<u>Percentage(%)</u>
Better income	17	51.5
Boost income	8	24.2
Employment	5	15.2
Purchase a bicycle	3	9.1
Total	33	100.0

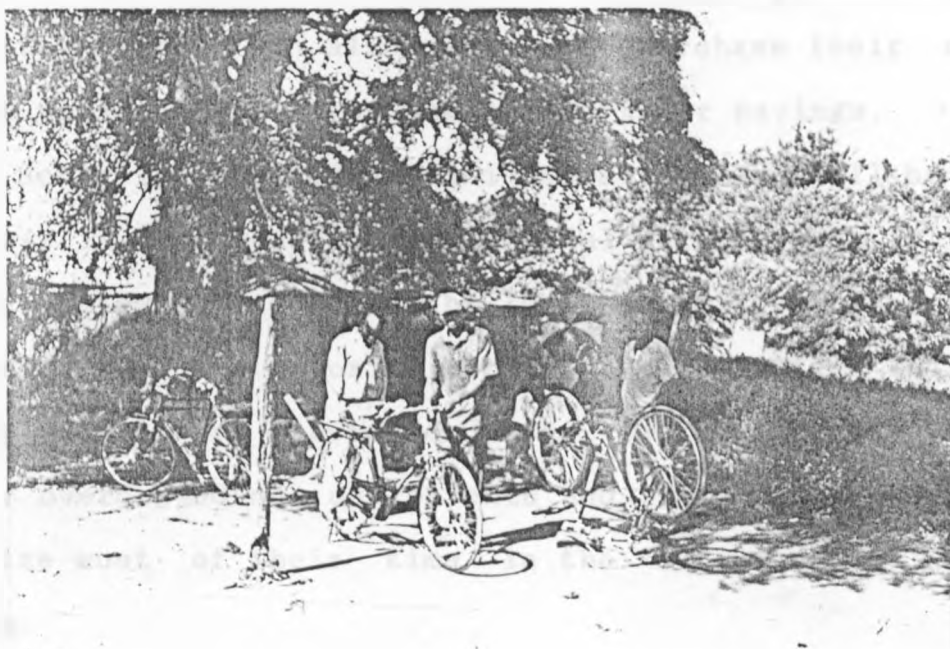
Source: Field Survey 1996

The problem of poor road condition in the area and low motorised modes ownership in the divisions further proves that the activity is viable. The improvement of the condition of these roads is impeded by lack of funds and machinery according to the Rural Access Roads officer in Nyando/Kadibo. However, even the improvement of the road conditions will still not reduce the level of the activity but will possibly encourage it. This fact is supported by the observation of the up coming and fast growing passenger bicycle transporters between Kondole in Kisumu town and Kibos along a tarmacked road with several matatus.

The operation is also sustainable in that the operators get the repair services within the area. The study revealed that

100% of the operators get their repair services from the local repairers some of which are located along the roads(Plate 4.4). However, some of the minor repair work are done by the operators themselves. The maintenance and repair costs are also minimal compared to the net monthly incomes generated from the activity as stated below.

PLATE 4.4 A BICYCLE REPAIRER ALONG KOROWE-NYANG'ANDE ROAD



Source: Field Survey 1996

(a). Net income for hirer operators

Average monthly income (Ksh.180 x 24 days)	=	4320.00
Average monthly maintenance cost	=	300.00
Average monthly hiring fee(Ksh.50 x 24 days)	=	<u>1200.00</u>
		1500.00
Net monthly Income		3120.00

(b). Net income for Owner-operators

Average monthly income (Ksh.180 x 24 days)	= 4320.00
Average monthly maintenance fee	= 300.00
Net monthly Income	= 4020.00

These results further confirms the fact that the nodes can still be maintained using less amount. Those hiring out can also continue to buy more from the amount generated while the operator-hirers can also manage to purchase their own within a short period if they can improve on their savings.

Socially, the Ngware-ini operation can still be sustainable in that it has reduced some social malpractices in the region. An interview with some of the local administrators and households revealed that the majority support the activity. This is because young people are getting employed in the activity hence reduce their overdependence on parents and theft in the region. They utilize most of their time in the activity with little idle times.

CHAPTER FIVE
COMPLEMENTARY ROLE OF NGWARE-INIS IN
TRANSPORT SERVICES AND EMPLOYMENT GENERATION

5.0.0 Introduction

Previous studies have indicated that no single transport mode can fulfil the transport demand in a given area. As different modes offer transport services, they complement each other due to their uniqueness and users preferences. This chapter addresses the complementary role of Ngware-ini amidst other modes both in the transportation of passengers and goods. Similarly it discusses the complementary role of these modes in the employment generation in the Nyando/Kadibo Divisions.

5.1.0 Transport Services

The existence of various modes of transport offers the travellers a wide range of modal choice. The reason being that the mode users have different preferences they attach to the modes used. On the other hand, each and every mode has its own uniqueness above other modes in meeting the transport demand in a given area. This implies that, the complementarity of the modes offer an efficient and quick transport. One of the aims of transport planning is to achieve an efficient transport system where there is an easier and fast movement. There is therefore a need to promote the use of each and every mode that encourages the transport efficiency.

5.1.1 Passenger transport

The modes offering passenger transport services within the Divisions are matatus and bicycles. The main areas generating passenger traffic are the markets, main transport corridors, farms and homes. The passenger trips generated include market, business, social, farm, roadside and home trips. The market trips are those made for shopping purposes while business ones are for the small scale traders travelling to markets to sell their merchandise in the markets. Social trips included visits, attending burials and journeys. The roadside trips makers are those travelling to the roadside to catch other modes as buses to various destinations. Home trips are generated by either markets or transport corridors while farm trips are for those going to farms located far a way from their homes and use other modes when going to supervise the activities going on.

5.1.2 Matatus

The matatu mode of transport was discovered to engage in meeting some of these transport demands. They normally transport an average of 14 passengers per trip on their routes of operation. Their service is high on market days as compared to other days of the week. On such days, they can make an average of six trips between their origins and destinations (Table 5.1). Their users like them because they are faster in movement, charge same fare as bicycles and have cover incase of rains or hot sunshine.

Table 5.1 Average number of daily matatu trips on routes

<u>Routes</u>	<u>No of trips</u>		<u>Fare charge(Ksh)</u>
	<u>Market</u>	<u>Non-Market</u>	
Rabuor-Nyang'ande	5	2	15
Ahero-Ombaka	7	3	20
Rabuor-Kaloleni	4	1	45
Korowe-Nyang'ande	5	2	20

Source : Field Survey 1996

Even though matatus play a vital role in passenger transport services on these routes, they have some limitations in terms of the weather conditions, and time taken before departure. During the rainy seasons their operation reduces to some times single mode on some routes due to poor road conditions. On the other hand, on non-markets days they take too long when waiting for passengers to fill their vehicles. The duration of waiting can be between one to two hours. On the same note, their agents who sometimes try to swindle some of the collected money, take too long in making the total count and addition. This raises complaints from travellers which on the other hand lead to their loss of more customers. They are also limited in that the nodes are not properly maintained and hence their rate of breakdown is high. This explains as to why they are unpredictable in some of their routes.

5.1.3 Ngware-inis

Ngware-inis are the other alternative passenger transport nodes a part from matatus operating in Nyando and Kadibo Divisions. They operate on similar routes as the matatus but they move beyond the regular matatu destinations, that is, the areas having narrow paths. Their operation is also high on

market days but moderate on other days as compared to the matatus(table 5.2)

Table 5.2 Average number of daily Ngware-ini trips on routes

<u>Routes</u>	<u>No of trips</u>		<u>Fare charge(Ksh)</u>
	<u>Market</u>	<u>Non-Market</u>	
Rabuor-Nyang'ande	10	5	15
Ahero-Ombaka	10	4	20
Rabuor-Kaloleni	4	2	45
Korowe-Nyang'ande	13	6	20

Source: Field Survey 1996

Household interviews revealed that majority use Ngware-inis in social trips(40%) followed by market and business trips(35%), hospitals (15%) and others(10%). These people use them because they are fast and accessible to them.

5.1.4 Modal Distribution and Passengers Transported by time of day

Traffic counts were carried along certain routes where matatus and bicycle movement were found to be regular both on market and non-market days. This was done with a view to ascertain the level of transport demand fulfilled by these modes in passenger transport. The chosen time of the day was when most of the people were travelling to and from the main transport corridors and markets. The routes selected were Korowe-Nyang'ande, Rabuor-Nyang'ande roads, and Ahero-Ombaka. A part from the nodes counted, the approximate number of passengers transported per day and waiting time by these two different modes was calculated(tables 5.3, 5.4, 5.5).

5.3 Traffic Count Along Ahero-Ombaka Road

<u>Day/Time</u>	<u>Number of nodes</u>		<u>No of passengers per node</u>		<u>No of passengers per hour</u>	
	<u>Matatu</u>	<u>Bicycle</u>	<u>Matatu</u>	<u>Bicycle</u>	<u>Matatu</u>	<u>Bicycle</u>
Tuesday 10-12pm	4	120	14	1	28	60
Thursday 10-12pm	2	60	14	1	14	28

5.4 Traffic Count Along Rabuor-Nyang'ande Road

<u>Day/Time</u>	<u>Number of nodes</u>		<u>No of passengers per node</u>		<u>No of passengers per hour</u>	
	<u>Matatu</u>	<u>Bicycle</u>	<u>Matatu</u>	<u>Bicycle</u>	<u>Matatu</u>	<u>Bicycle</u>
Thursday 10-12pm	3	90	14	1	21	45
Monday 10-12pm	1	46	14	1	7	24

5.5 Traffic Count Along Korowe-Nyanga'nde Road

<u>Day/Time</u>	<u>Number of nodes</u>		<u>No of passengers per node</u>		<u>No of passengers per hour</u>	
	<u>Matatu</u>	<u>Bicycle</u>	<u>Matatu</u>	<u>Bicycle</u>	<u>Matatu</u>	<u>Bicycle</u>
Friday 10-12pm	2	100	14	1	14	50
Saturday 10-12pm	Nil	50	14	1	0	25

Source: Field survey 1986

The figures illustrates that on both days of the week, bicycles transport more passengers than matatus on all the routes. On some days, it sometimes take more than two hours before passengers get a matatu to their destinations. For example along Korowe-Nyang'ande route, no matatu was seen transporting passengers to either directions. The matatus trips were also found to be concentrated along Ahero-Ombaka and Rabuor-

Nyang'ande routes as compared to Korowe-Nyang'ande route.

Taken that the nodes operate for an average of 10hrs/day, the total number of passengers transported by both the nodes are as stated below(table 5.6).

Table 5.6 Total Passengers transported by routes, mode and day

<u>Routes</u>	<u>Mode Type</u>			
	<u>Matatu</u>		<u>Ngware-ini</u>	
	<u>No. of Passengers</u>	<u>No. of Passengers</u>	<u>No. of Passengers</u>	<u>No. of Passengers</u>
	<u>Market</u>	<u>Non-market</u>	<u>Market</u>	<u>Non-market</u>
Ahero-Ombaka	280	140	600	300
Korowe-Nyang'ande	140	-	500	250
Rabuor-Nyang'ande	210	70	450	230
Total	630	210	1550	780

Source: Field Survey 1996

The data was used to test the hypothesis that there is no significant difference between the number of people transported by the Ngware-inis and the number transported by the matatus.

H₀ There is no significant difference between the number of people transported by the Ngware-inis and the number transported by the matatus.

H₁ The number of passengers transported by the Ngware-inis is more than the number transported by the matatus.

Using the Chi-square contingency table, the row and column totals were calculated followed by the calculation of the value for the expected (E) was calculated for each cell in the contingency table(table 5.4).

Formula:

$$E = \frac{\text{Row Totals} \times \text{Column Totals}}{\text{Overall Total}}$$

Table 5.7 Chi-Square Contingency table for passengers by mode and day of week.

<u>Frequency</u>	<u>Mode</u>	<u>Market day</u>	<u>Non-market day</u>	<u>Total</u>
Observed	Matatu	630	210	840
	Ngware-ini	1550	780	2330
	Total	2180	990	3170
Expected	Matatu	577.7	262.3	
	Ngware-ini	1602.3	727.7	
$\frac{(O-E)^2}{E}$	Matatu	4.7	10.4	
	Ngware-ini	1.7	3.8	
		$(O - E)^2$		

The calculated $X^2 = \sum \frac{(O - E)^2}{E} = 20.6$

The tabulated statistic is obtained by using $(k-1)(h-1) = (2-1)(2-1) = 1$ degrees of freedom. At 5% significance level, the tabulated statistic = 3.84. The results indicate that the calculated value is greater than the value that would be likely to result by chance if the passengers transported by the different modes were equal. The null hypothesis was therefore rejected at 5% significance level. There is therefore the confidence that the numbers of passengers transported by the matatus and those transported by the Ngware-inis are different.

Ngware-inis were discovered to get more passengers mainly because their journey time is shorter as compared to the matatus. The shorter journey time was attributed to the fact that they

waste no time in wait for passengers and they are many in number such that a passenger can easily board them and reach his destination in time. In the examination of the factors determining modal choice between the matatu and Ngware-ini users in Nyando/Kadibo, it was found that they are time, convenience, distance and comfort.

However, the key factor determining modal choice in the off-road transportation within the divisions is time. Out of the passengers interviewed 73.3%, and 57.2% of Ngware-ini and Matatu passengers respectively said that they use the modes because they are fast. However, matatus were found to delay as compare to Ngware-inis in that the latter are one passenger transport modes while matatus take long hours to wait for passengers to fill their nodes. Out of the matatu operators interviewed, 100% confirmed that they experience delay and the reasons given are the existence of Ngware-inis and less passengers.

The household interviews revealed that 59.4% had used Ngware-inis in various trip purposes. When they were asked how long they wait for matatus and Ngware-inis, on their routes of operation, it was found out that the latter take less time as compared to the former. The mean time taken in wait of Ngware-inis and matatus was found to be 3.2 and 115.8 minutes respectively.

T-test technique was used to prove whether time is a significant factor in modal choice in Off-road transport.

Formula:

$$t_{N-1} = \frac{\bar{x} - \mu}{\sigma / \sqrt{N}}$$

Where:

\bar{x} = Sample mean time taken by Ngware-inis

μ = Mean time taken by matatus

σ = Sample standard deviation

N = Size of the sample

$N-1$ = Number of DF appended to t to accommodate the estimate in the numerator (\bar{x}) and the estimate in the denominator (σ).

The null and the alternative hypotheses were that;

H_0 = The mean waiting time for bicycle operation is equal to or greater than the mean waiting time for the matatus

H_1 = The mean waiting time for Ngware-inis is less than the mean waiting time for the matatus.

The study found out that;

The mean waiting time for Ngware-inis = 3.2 minutes

The mean waiting time for Matatus = 115.8 minutes

$$t_{(40-1)} = \frac{(3.2 - 115.8)}{2.4 / \sqrt{39}} = \frac{(3.2 - 115.8)}{(2.4 \times 6.2)}$$

$$t = -7.54$$

The computed value -7.54 was then compared with the t value at 95% significant level. The tabulated t -value for 39 Df was found

to be 0.682 at the same significant level. This indicated that the tabulated is higher than the calculated. Therefore the null hypothesis was rejected and the alternative adopted that the mean waiting time for Ngware-inis is less than the that of matatus.

Other factors determining modal choice were distance, convenience and comfort. The matatu users considered them better for long distance travel possibly beyond 10km and they are comfortable in that they have covers against severe weather. Ngware-ini users also consider them convenient in that they mostly transport them to the final destinations as homes since the operators know the places. It was interesting to discover that even the Ngware-ini users consider them to be comfortable in that they do not experience in-vehicle congestion as in matatus.

However, even though Ngware-inis are useful to the majority they also have some limitations that discourage others from using them. Cross tabulation indicated that out of the 40.6% of households who do not use them, 46.6% had their own modes, 26.1 fear and have low opinion on them while 25.5% had not had the opportunity to use them. The fear of using them is due to their high speed they sometimes apply in their trial to ferry more passengers per day in order to get more income. The users view on these modes limitations was different in that 64.6% said they had never experienced any problem when using Ngware-inis.

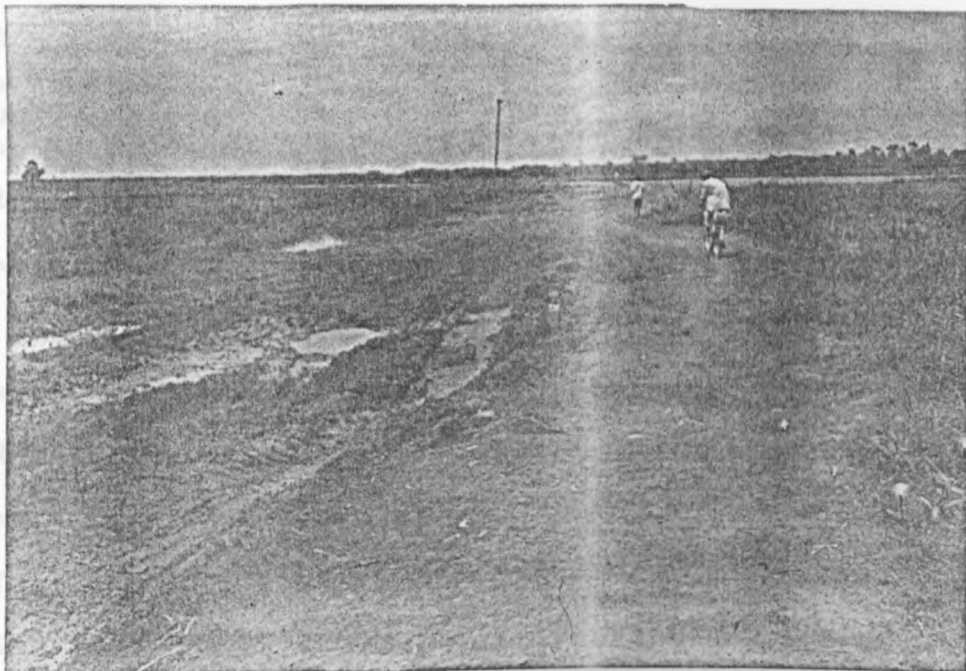
However, for 34.6% who had experienced a problem when using them, 42% cited the problem of hard seats, 23% high speed, 35% poor roads. The problem of hard seats was experienced mostly by passengers using Ngware-inis that had not been well cushioned as the rest. The high speed was formerly experienced but it was

discovered that the operators nowadays move according to the directive of their customers. The problem was also mostly reported by women who sometimes try to jump off the modes due to fear.

5.1.5 Accident Records of Ngware-inis

Accidents have been realised in the course of the modes operation in passenger transport on their regular routes. It was discovered that most of these accidents are simple ones as bruises on arms or legs incase someone falls off the bicycle. However there was only one case when a fatal accident was recorded that later led to death. An interview with the operators revealed that the causes of accidents are due to the poor road conditions and the overtaking by the motorised traffic like the tractors. After the rains, most parts of the roads are potholed and sometimes filled with water hence they use only narrow ridges on the roads(Plate 5.1). Because of the little

PLATE 5.1 NARROW RIDGES ON THE ROADS ALONG RABUOR-NYANG'ANDE ROAD



Source: Field Survey 1996

space for movement and with possible miscalculation of each others speed, they sometimes collide. In some cases, the motorised nodes overtake them so poorly that they are forced to veer off the road and hence fall on the ditches.

However, the accidents are sometimes caused by the passengers who try to jump off the bicycles due fear of the possible accidents. A part from women, the problem of jumping was found to be common with the non-residents of Nyando/Kadibo who are not used to the bicycles.

The rate of accidents used to be higher when the activity was started but it has been reducing with time(table 5.8). The higher rate was attributed to the operators lack of expertise in the activity and the passengers lack of trust on the operators. On the other hand, the reduction has been due to the experience of the operators and the passengers familiarity with the nodes.

Table 5.8 Accident Records 1990-1994

<u>Route</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>
Ahero-Ombaka	18	9	8	6	4
Korowe-Nyang'ande	8	5	6	4	3
Rabuor-Nyang'ande	9	7	8	5	4
Total	35	20	22	15	11

Source: Field Survey 1996

Information on accident records for the past four years got from the Ngware-ini association leaders indicated that the rate of accidents have been reducing.

The low accident rates and their less fatality implies that bicycles are suitable nodes for rural transport as compared to

the motorised modes as it has been reported in other parts of Kenya. However, it can be pointed out that the accident records from the Police Station could not be easily found due to lack of co-operation from the officers concerned. The promotion of bicycle use in the region can reduce the road carnage experienced from the motorised modes.

5.2.0 Goods transport services

In Nyando/Kadibo there are different types of goods that need to be moved by all types of modes as the matatus, tractors, trucks, pick-ups, wheelbarrows, animal carts and the bicycles. These include agricultural products as rice, sugar cane, cotton, vegetables, and maize; other goods are business merchandise, parcels, luggage, letters and other household goods. The suitability of different types of modes in the movement of these goods is determined by distance, terrain, type and quantity of the goods and speed(table 5.9).

The information in the table indicate that tractors can move more goods compared to other modes and are best suited in both hilly and plain areas where there are wide tracks. However, bicycles can move 1/10 of goods moved by the tractors but are suitable in flat areas having narrow paths. compared to other modes, bicycles are better in that they can move at a higher speed, long distances and does not need smooth surfaces.

In Nyando/Kadibo Divisions, tractors and pick-ups were found to be mostly used in the transportation of bulky goods by large scale businesses and farmers. They are hired in the transportation of such goods like rice, sugarcane, wholesale shop

merchandise. Since, few people own these modes and engage in large scale farming, it implies that minority of the Nyando/Kadibo residents use them. The matatus are mostly engaged in the transportation of passengers and in rare cases transport goods as households and farm produce. The goods they mostly transport are passenger luggage because most of them lack couriers for bulky goods. They also consider goods transportation together with passengers dangerous in that it can lead to accidents due to poor roads.

Table 5.9 Mode Type by Good, Speed, Range and Terrain Requirement

<u>Vehicle</u>	<u>Load (Kg)</u>	<u>Speed (km/h)</u>	<u>Range (km)</u>	<u>Terrain</u>
Wheelbarrow	120	3-4	1	-Reasonably flat -Smooth surface
Handcart	180	3-5	3-5	-Reasonably flat -Very smooth surface
Bicycle	80	10-15	40	-Reasonably flat paths
Bicycle & Trailer	150	10-15	40	-Reasonably flat wide paths
Animal-drawn sledge (buffalo)	70-150	3-5	20	-Reasonably flat:wide track
Single-axle tractor	1500	10-15	50	-Moderate hills wide track

Source: Howe, J. Conceptual Framework for Defining and evaluating Improvements to Local Level Rural Transport in Developing Countries(Geneva, ILO, September 1983), pp.36-37.

The study findings revealed that majority of Nyando residents use other non-motorised forms of transport compared to

the motorised ones(table 5.10).

Table 5.10 Goods transport modes in Nyando/Kadibo

<u>Mode type</u>	<u>Percent(%)</u>
<u>Motorised</u>	
Tractors	2.2
Pick ups	<u>1.8</u>
	4.0
<u>Non-Motorised</u>	
Human portorage	60.2
Bicycles	25.0
Handcarts	1.8
Animal sledges	4.0
Donkeys	2.4
Wheelbarrows	<u>2.6</u>
	96.0
Total	100.0

Source: Field Survey 1995

Bicycles are the second leading modes in goods transportation. This explains as to why people use Ngware-inis in goods transport within the region. A part from the bicycles some people use donkeys, hand-carts and wheelbarrows. Animal sledges were also found to be widely used in the interior parts in the transportation of both rice and building materials as grass and soil(Plate 5.2). They are used because they can transport bulky goods easily in areas which are muddy that neither the bicycles nor other wheeled modes cannot move on easily.

5.2.1 Ngware-inis and Goods Transport

A Part from passenger transport, the modes also offer goods transport services to the Nyando/Kadibo residents. The goods transported include rice, vegetables, sugarcane, luggage, parcels, shop merchandise, and furniture among others. Out of the operators interviewed, 95% said that they transport goods. Further analysis on goods transported revealed that majority

transport rice, followed by vegetables and luggage/parcels (table 5.11)

PLATE 5.2 BULLS PULLING GRASS ON ANIMAL SLEDGE



Source: Field Survey 1996

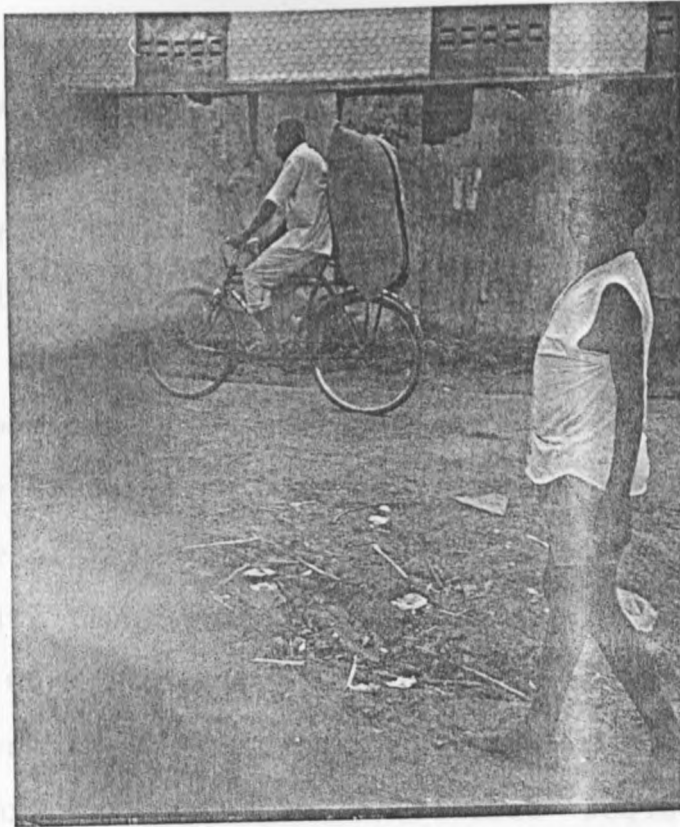
Table 5.11 Type of goods transported by Ngware-inis

<u>Good Type</u>	<u>Percentage(%)</u>
Rice	35.5
Vegetables	22.6
Luggage/parcels	19.4
Shop merchandise	9.7
Furniture	3.2
Others	9.6
Total	100.0

Source: Field survey 1996

Ngware-inis were found to play a vital role in rice transportation from the paddies to either homes or the milling machines(Plate 5.3).

PLATE 5.3 NGWARE-INI OPERATOR TRANSPORTING RICE TO MILLING A
MACHINE IN AHERO TOWNSHIP



Source: Field Survey 1996

They are mostly used by the small scale farmers, and traders who cannot manage to hire tractors and pick ups in the transportation of their produce. The advantage these modes have over the other modes is that they can reach some parts of the paddies having very narrow and muddy lanes that the other motorised modes cannot reach. Compared to head loading, Ngware-inis transport more rice at a given time.

It was discovered that during the harvesting period, about 50% of the Ngware-ini operators temporarily leave passenger transportation and engage in rice transport. The average number of sacks an operator can transport during that time is 10 sacks

per day in a distance of between 5-10km. Taken that 50% of the operators join rice transportation, they can transport 3000 sacks per day.

Ngware-inis

50% of operators = 200

Number of trips per day = 10

Quantity of a sack of rice = 90kg

Total Quantity transported per day = 3000 sacks(270,000kg)

Headloading

Number of porters = 200

Number of trips per day per person = 10

Quantity transported per trip = 16kg

Total Quantity transported per day = 356 sacks(32,000kg)

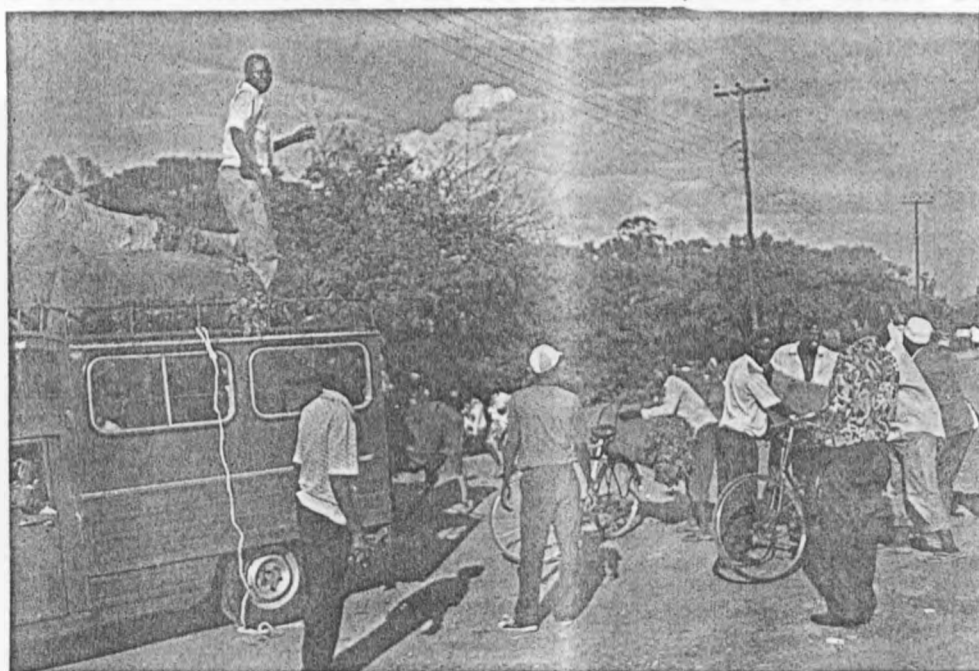
The results indicate that bicycles can transport almost 10 times per day the amount of rice that would transported over long period by head loading or at exorbitant charges by the motorised modes.

Small scale rice traders transacting directly with the farmers find them convenient because the modes help in reducing their time and transport cost. Because of trust they have developed between them and traders, they can be sent to farms where the purchased rice is and they transport them to the required destination by the business person. This leaves the trader more time of attending to other activities as looking for more rice, drying and milling some. On the other hand some of these traders purchase less quantity of rice as two to three sacks which is more costly to transport if one hires a pick up. Ngware-ini operators charge Ksh.70 per sack for a distance of

between 5-6km meaning that for three sacks they can charge Ksh. 200 whereas a pick up when hired charges Ksh. 400 for such a distance and quantity.

Vegetables is the second agricultural produce mostly transported by the Ngware-inis. It is mainly grown along the lake shores in large quantities. The modes transport them to the transport corridors particularly in Ahero from where they are either transported to Nairobi, Kisumu or sold locally(Plate 5.4).

PLATE 5.4 VEGETABLES LOADED TO MATATUS FROM NGWARE-INIS



Source: Field Survey 1996

transportation of vegetables due to some reasons. Generally, the utility of a good to the business people is determined by its quality and price which are in most cases depends on transport cost. Poor transport system can lead to the rise or fall of the price of a good on the demand zone. On the other hand it can

cause the destruction of the good at the production point. Ngware-inis have some advantage over other modes in the

Vegetables, once harvested, need quick transportation to the consumption point since they dry up easily unless there is a cold storage facility which the rural small scale traders do not have. Since the roads between the vegetable production zone are poor and the matatus are unpredictable, Ngware-inis play an important role to these traders in that they can use the narrow hard way leaves which other modes cannot use even during the rainy seasons(Plate 5.5).

PLATE 5.5 NARROW WAYLEAVES USED BY NGWARE-INIS IN RAINY SEASON



Source: Field Survey 1996

The other farm produce transported by Ngware-inis is soft sugarcane imported to the region by traders for local consumption from other districts as Kisii and Kakamega where it is grown at a

larger scale(Plate 5.6)

The other goods transported by these modes are the luggage and different parcels. Out of the operators interviewed, 55% said that they transport passengers with goods while 45% do not. The reason why some do not is because they have little couriers and less pay because they are forced to distribute the goods to their colleagues. The parcels transported by the Ngware-inis include letters and money. Because of the trust some of the customers have developed with the operators and the operators well knowledge of the villages within their areas of operation, some use them in sending their letters and money to their

PLATE 5.6 NGWARE-INIS TRANSPORTING SUGARCANE



Source Filed Survey 1996.

families or workers. This happens mostly to people whose homes are located far interior and would not like reaching the places

due to some commitments. Some of these are farmers operating some businesses in Ahero, Rabuor or Kisumu and have some farm labourers working on their rice paddies. Instead of wasting time in travelling to and from these places, they send the Ngware-ini operators who send the parcels at agreed charges. Itinerant traders and fish mongers, particularly women, find them convenient in sending such goods as food to their homes for earlier preparation as they continue with their businesses which ends late in the evening.

The time saved in the transportation is far much profitable to the traders than the amount spent. An interview with the women rice traders revealed that things being equal, they carry out their business for approximately 10hrs per day and can sell 60 2kg tins of rice per day where each was costing Ksh.70. This implies that;

Income per day	=	Ksh 4200
Tins sold per hour	=	6
Income per hour	=	Ksh. 420

Since the majority of these traders homes are located 5km and above which takes an average of 40 minutes to and from the markets, it implies that one can loose Ksh. 90 in transportation. This is where Ngware-ini operators play an important role in that at such distances they charge only Ksh. 20 for the goods transported saving the business person Ksh. 70. The operators also benefit on the other hand in that as they transport the commodities they sometimes get others small goods or passengers which they charge differently.

Small scale business persons owning shops and kiosks and the

bicycle repairers also benefit from the Ngware-ini operation in the transportation of their small quantity of goods from wholesale shops in larger urban centres as Rabuor, korowe and Ahero. Some of these goods are too small and costly to transport when the business persons travel to purchase them alone. They include packets of tablets and ciggarets, few loaves of bread, bar soaps and packets of milk among others. Since some of these goods are too small, they transport them together with the passengers from the centres. An interview with some of the business persons in Nyang'ande using the modes in the transportation of their goods indicated that the modes reduce their transport cost and increase their profit. A sample of commodities were taken and transport cost and balance profit analyzed if the business owner travel to purchase the commodity alone and when a Ngware-ini operator is sent(table 5.12)

Table 5.12 Transport cost and profit

<u>Commodity</u>	Profit after sale (Ksh)	<u>Cost of transport(Ksh)</u>		<u>Balance of profit(Ksh)</u>	
		<u>Ngware-ini</u>	<u>Owner</u>	<u>Ngware-ini</u>	<u>Owner</u>
1 crate of bread	30	20	50	10	-20
1 carton of bar soap	50	20	50	20	0
1 pct of cigarette	10	5	20	5	-10

Source: Field Survey 1996

The results clearly indicates that the modes promote the utility of the goods and increases the business peoples profit at the same time. These small scale business people can only realize

more profit if they purchase goods in large quantity; organise group transport, or send someone travelling to the urban centres which is quite inconveniencing.

The Ngware-inis were also found to be important in the movement of such special goods as coffins from the carpentry shops in the market centres to homes incases where a dead body is not taken to a mortuary, a common practice in rural areas. For a distance of between 4-5 km, the matatus and pick-ups were found to charge approximately Ksh. 200 while the Ngware-inis charge Ksh. 100. The transportation cost together with the roads and paths condition in the rural areas, make these non-motorised modes be of great importance in such occasions.

5.3.0 Ambulance Services

In Nyando/Kadibo divisions there few health centre, dispensaries and private clinics. These facilities are sparsely populated such that majority live far a way from them where the average of distance was found to be 5km. The modes used to hospitals and health centres include walking/shoulder(67.6%), bicycles(25.7%), car(0.4%) pick-ups(0.2%), others(6.2%). The findings reveal that bicycles are the second leading mode used in seeking medical services.

Most of the existing health centres in the region are faced with the problem of inadequate ambulance vehicles such that in case of emergencies, the residents have to use other alternative means. By the time of this study there was only one ambulance serving both the public health centres in the divisions which was also taken to Nairobi for repairs. Implying that incase an

emergency arose the hospital staff had no otherwise. However, even if the ambulances are there, they are mostly used in the transportation of ill patients from the health centres to bigger hospitals. The other problem facing the rural inhabitants is that they are not well serviced with the telephone lines which they can use to communicate to the hospital staff incase they have emergencies. The only alternative for the residents is to use the available modes to the hospitals as walking and bicycles for fairly sick patients and the matatus, bicycles, locally made stretchers, wheelbarrows and shoulders for serious ones. A part from matatus and bicycles, the other methods were found to be slow and dangerous for ill patients who need faster and careful attendance.

Currently many have started using the Ngware-inis in the transportation of their sick patients to the hospitals. The matatus are better in the transportation of patients but cannot serve well those people living far a way from the main roads as they are unpredictable and sometimes cannot reach the homes. This implies that patients must be carried by other means to the points where matatus can pick them to the hospitals. The Ngware-inis fill this gap in that they can easily move to the door-steps where the patients can be put on them and transported to the health centres. Though no proper records have been taken on the number of patients taken to Ahero health centre by various modes, the estimation by the hospital staff indicated that bicycles transport more patients than other modes(table 5.13)

Table 5.13 Number of patients and mode used

<u>Mode Type</u>	<u>Average Number of patients per month</u>	<u>Percentage (%)</u>
Matatus	20	5.3
Personal Bicycles	200	52.9
Ngware-inis	80	21.2
Handcarts	3	0.8
Wheelbarrows	10	2.6
Shoulder Stretcher	60	15.9
	5	1.3
Total	378	100.0

Source: Field Survey 1996

However, even though Ngware-ini are used in they have one limitation that they lack comfortable ambulance trailers for very ill patients.

5.4.0 Ngware-ini operation and employment generation

Unemployment both in the rural and urban areas is one of the serious problems facing Kenya. Trials are being made to promote the informal sector which is currently absorbing the growing labour force. Commercial non-motorised operation is another sub-sector in the informal transport sector that has the potentiality in creating employment.

In Ngware-ini operation there are both part-time 47% and full-time(53%) operators. The full-time operators were those who do not have any other income generating activity a part from bicycle operation while those who have were classified as part-time operators.

A comparison on the number of people employed in Ngware-ini operation and matatus showed that Ngware-ini employs more people as compared to matatus(table 5.14).

The total number of matatus and Ngware-inis operating within the study area was found to be 15 and 400 respectively. Even though matatus operators have one assistant each, still Ngware-ini operation employ more people than them.

Table 5.14 Level of Employment by mode

<u>Activity</u>	<u>Mode Type</u>	
	<u>Matatus</u>	<u>Bicycles</u>
Drivers	15	400
Assistants	15	-
Total	30	400

Source: Field Survey 1996

Comparing the average monthly incomes generated from Ngware operation and other sectors, the findings indicated that the operators get higher income where farming generates Ksh.2527, other sources Ksh. 2528, and Ngware-ini operation Ksh. 4500.

The student T-test technique was used to test the hypothesis that there is no significant difference between income from Ngware-ini operation and that generated from farming.

Formula:

$$t_{n-1} = \frac{\bar{x} - \mu}{\sigma / \sqrt{N}}$$

Where:

x = Sample mean monthly income from Ngware-ini operation

μ = Mean monthly income from agriculture

σ = Sample standard deviation

N = Size of the sample

N-1 = Number of DF appended to t to accommodate the estimate in the numerator (x) and the estimate in the denominator(σ).

The null and the alternative hypotheses were that;

H₀= The mean monthly income generated from Ngware-ini operation less than or equal to mean monthly income from agricultural produce.

H₁= The mean monthly income generated from Ngware-ini operation is higher than the mean monthly income from agricultural produce.

The study found out that;

The mean monthly income from Ngware-inis = Ksh. 4500

The mean monthly income from farm produce = Ksh. 2527

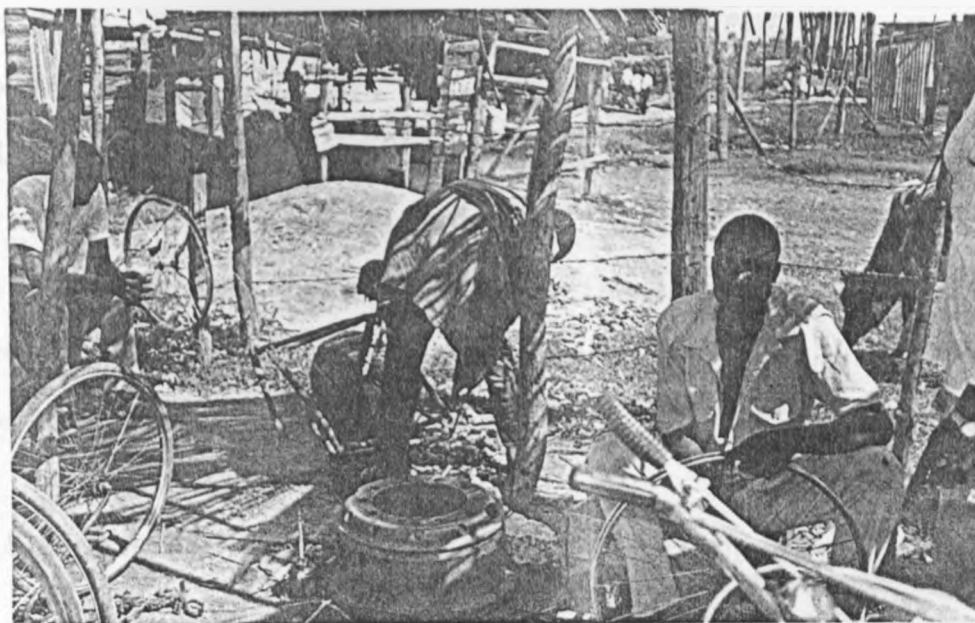
$$t_{(40-1)} = \frac{(4500 - 2527)}{1950 / 40} = \frac{1973}{12285} = 0.16$$

$$t = 0.16$$

The computed value 0.16 was then compared with the t value at 95% significant level. The tabulated t-value for 39 Df was found to be 0.682 at the same significant level. This indicated that the tabulated is higher than the calculated. Therefore the null hypothesis was rejected and the alterative adopted that the mean income generated by Ngware-ini operation is higher than that generated by agricultural produce.

The operation also offer indirect employment as fabrication of bicycle spares by the jua kali artisans(Plate 5.7).

PLATE 5.7 JUA KALI ARTISAN FABRICATING BICYCLE PARTS AT AHERO



Source: Field Survey 1996

This is because some of the bicycle parts of the new models are weak as the frames and since the artisan can easily model them using steel, the Ngware ini operators prefer them. The activity has also encouraged bicycle repair activities along their routes of operation. A survey indicated since the beginning of the activity the number of bicycle repairers have increased by an average of 63% on their routes(table 5.15)

Table 5.15 Percentage increase in Bicycle repairers 1990-95

<u>Route</u>	<u>1990</u>	<u>1995</u>	<u>% Increase</u>
Ahero-Ombaka	4	7	75
Korowe-Nyang'ande	3	5	67
Rabuor-Nyang'ande	4	5	25
Total	11	18	63

Source: Field Survey 1996

A sample of the repairers interviewed along the routes indicated

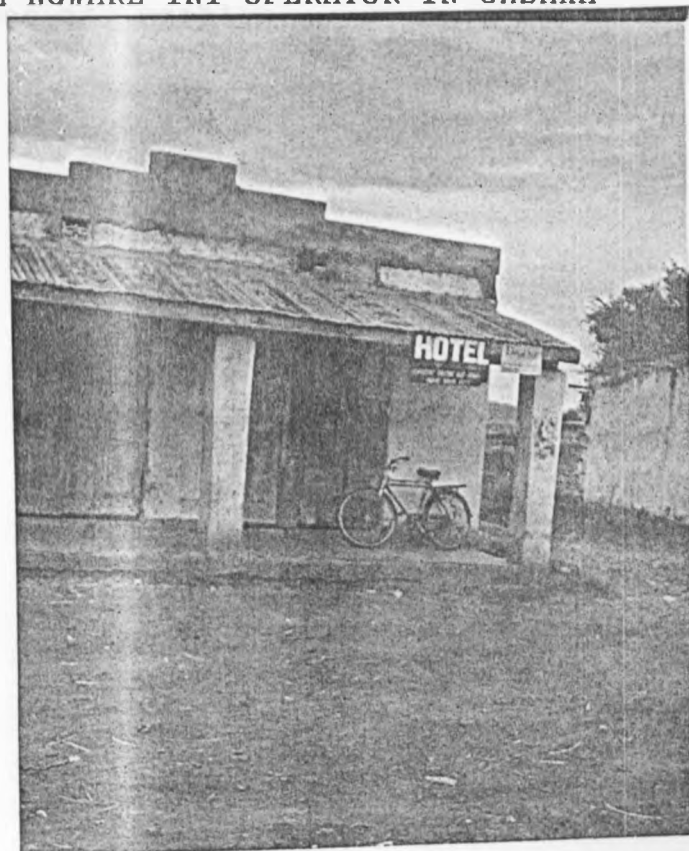
that 75% operate through out the week while 25% operate only on market days. However, on whichever day, the average income of the operators per day was found to be Ksh 250 implying that;

Full week operators monthly income = Khs.4000

Market days operators income = Ksh.1500

A part from bicycle repair activities, other indirect employment offered by Ngware-ini operation is are the coming up foods kiosks and hotels servicing the operators along the roads and in the market centres(Plate 5.8).

PLATE 5.8 A HOTEL STARTED BY A NGWARE-INI OPERATOR IN OMBAKA



Source: Field Survey 1996

Since the activity consumes more energy the operators cited that one needs to eat well, hence these kiosks and hotels assist them a lot. Some of these hotels and kiosks are operated by the Ngware-ini operators wives or cousins.

The study also revealed that Ngware-operation have attracted

people from other parts of Western Kenya to such urban centre as Ahero and Rabour where the activity is concentrated. Out of the operators interviewed, 12.5% come from Kakamega, Homa Bay and Siaya Districts.

However in the course of the operators daily transport activities, they are faced with such problems as frequent breakdown of the new bicycle models(2.0%), poor roads(61.5%), fast motor vehicles(4.0%), tractor obstruction(2.5%) and careless driving(2.5%). However, it was interesting to note that 27.5% said that they do not experience any problem.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

The overall study problem was to find out the viability and key roles of the Ngware-inis in Nyando/Kadibo divisions both in the transport services and employment creation. The objectives of the study were to investigate factors determining modal choice in the off-road transportation, examine the operation of the bicycles as a rural transport mode, assess the level of employment opportunities generated by the Ngware-ini operation and to recommend ways and means of the efficient use of Ngware-inis and other non-motorised transport modes in the region.

The hypotheses set to guide the study were that, the mean waiting time for bicycle operation is equal to or greater than the mean waiting time for the matatus, the mean monthly income from Ngware-ini operation is less than or equal to the mean monthly income from agricultural produce and that the number of passengers transported per day by Ngware-inis is equal to the number transported by the matatus. It was also assumed that operation of the Ngware-inis do not offer any significant direct or indirect employment to the Nyando/Kadibo residents.

Using Chi square technique in testing the hypothesis on the number of passengers transported by the modes, the calculated and tabulated values were found to be 20.6 and 3.8 respectively at 5% significant level. The null hypothesis was therefore rejected at 5% significant level and alternative adopted that the number of passengers transported by the matatus and those transported by the Ngware-inis are different. The Ngware-inis were found to

transport more passengers along the transport corridors per day compared to the matatus mainly because of their short journey time. This is because they waste less time in wait for passengers and they many in number such that a passenger can easily board them and reach his/her destination in time.

The factors determining modal choice between matatus and Ngware-ini users in Nyando/Kadibo divisions were found to be time, convenience, distance and comfort. However, time was the key factor in the off-road transportation. The mean waiting time for Ngware-inis and matatus are 3.2 and 115.8 minutes respectively. Using the T-test technique, the calculated and the tabulated values were found to be -7.54 and 0.682 respectively. This indicated that the tabulated is higher than the calculated. Therefore the null hypothesis was rejected and alternative adopted that the mean waiting time for Ngware-inis is less than that of matatus. All of the matatu operators interviewed, confirmed that they experience delay and the reason given are the existence of Ngware-inis and less passengers.

The average monthly incomes from Ngware-ini operation and farm produce sales were found to be Ksh.4500 and Ksh.2527 respectively. T-test technique was used to test the hypothesis that there is no significant difference between income from Ngware-ini operation and that generated from farm produce. The computed value was found to be 0.16 while the tabulated value 0.682 indicating that the tabulated ins higher than the calculated. Therefore the alternative was adopted that the mean monthly income generated by the Ngware-ini operation is higher than that generated by agricultural produce.

Ngware-ini operation was found to employ more people compare to matatus. The approximate number of people employed in matatu and Ngware-ini operation was found to be 15 and 400 respectively. Even though matatu operators have one assistant each, still Ngware-ini operation employ more people than them. Ngware-ini operation also offer indirect employment such as the fabrication of the bicycle spares by the jua kali artisans and bicycle repair work along their routes of operation. Other indirect employment offered include the coming up kiosks and hotels servicing the operators along the roads and in the market centres. The activity has also attracted people from other parts of Western Kenya as Kakamega, Homa Bay and Siaya districts to such urban centres as Ahero and Rabour where the activity is concentrated.

In terms of the viability of Ngware-inis as a rural transport mode, it was found out that majority approve it because it reduces their travel time and inconveniences. The reason being that these modes can reach their homes and are always available in times of need. The modes have also greatly controlled the former frequent transport fare rises by the matatus. Their technical aspects also qualify them as suitable transport modes in that they can be repaired and some of their parts fabricated locally.

Ngware-inis were found to also offer goods transport services. They transport such goods like rice, vegetables, sugarcane, luggages, parcels, shop merchandise and furniture among others. Out of the operators interviewed, 95% said that they transport goods. They mostly play a vital role in rice transport from the paddies to either homes or to milling machines

for small scale farmers and business people. The advantages they have over other modes in goods transport is that they can reach some parts of the paddies having very narrow and muddy lanes that other motorised modes cannot reach. Compared to headloading, Ngware-inis transport more rice per day.

Small scale business persons owning shops and kiosks and the bicycle repairers also benefit from the Ngware-ini operation in the transportation of their small quantity of goods from wholesale shops in larger centres as Ahero, Rabuor and Korowe. The Ngware-inis were also found to be important in such special goods as coffins from the carpentry shops in market centres to homes for burial incases where a dead body is not taken to a mortuary, a common practice in the rural areas. The modes also offer ambulance services to the local people. The advantage they have over other modes is that they can easily move to the door-steps where the patients can be put on them and transported to the health centres.

In the process of the modes offering of transport services, they complement the motorised roads in the traffic build-up along the main transport corridors. They collect traffic from the interior parts of the divisions to the corridors where long distance travellers board other modes of transport as matatus and buses. The role assist in the sustainabilit of the services of the motorised modes as matatus and buses which mostly operate only on certain routes if they can get maximum business that can generate enough traffic.

6.2 Conclusions

The former trends of viewing transport planning as the provision of all weather roads for motorised modes should change in that these roads serve minority as the level of motorised modes ownership has continued to be low. The consistent construction and regular maintenance cost of these roads have proved to be beyond the reach of most of the developing nations. This has alternatively discouraged the operation of the motorised modes particularly in passenger transport off-the main transport corridors. The provision of these roads is therefore not the only solution to the enhancement of rural transport services but also the provision of appropriate modes of transport.

Ngware-inis as appropriate modes, are viable and play important roles to the Nyando/Kadibo division residents. They reduce immobility while encourage faster travel. Time, unlike previously thought, is a critical factor in modal choice in rural areas just like in the urban centres. Because of the diverse activities that require the rural inhabitants' attention in their bid to raise their standard of living with time, their transport demand should be satisfied. This satisfaction can only be achieved by the use of appropriate modes as the bicycles that are within their reach.

The operation of Ngware-inis has a potentiality in offering employment to some of the unemployed Nyando/Kadibo divisions it can be encouraged. On the other hand it can assist in the alleviation of rural poverty through the raising of their incomes which is one of the aims of developing nations as Kenya. Its promotion can also lead to further creativeness in the informal

sector towards the manufacture of the bicycle parts in the region, a move which support sustainable rural development.

Ngware-inis can be sustainable rural transport modes in that bicycles are acceptable to the community and its technical requirements can be met by the local experts and people. The maintenance cost of these operators is not costly as compared to the motorised ones. On the other hand, the continued full price rises implies constant rise in motorised transport service charges. However, since the modes are human powered, their charges will not increase to the level of the motorised ones hence they will still assist in controlling transport service charges on their routes. Since agriculture is mainly practised in rural areas, the regions should be environmentally sound. The use of these modes, can therefore be a solution to the rural environmental problem in that they do not emit destructive fossil fuel products that can cause harmful effects to the crops.

6.3 Recommendations

One of the strategies to achieving an effective rural transport planning should be to provide and encourage the use of appropriate modes in terms of incomes, transport cost and needs, and the technological capability of the rural inhabitants. This will result into efficient movement and increased development. One of the aims of the study was to recommend ways and means of improving Ngware-ini operation in Nyando/Kadibo divisions since the modes encourage mobility and offer employment that result into the areas development.

Institutional Issues

The study revealed that one of the limitations towards the efficient use of Ngware-inis is the people's attitudes towards them. There is also the general lack of awareness of the key transport roles they play in the region. The activity is also not well organized by the existing association. The other problem facing the operators is the business management.

1. There is a need to create the awareness of the suitability of the Ngware-inis both to the Nyando/Kadibo residents and local administration. The information dissemination channels should include barazas, seminars, local publication and radios. This can be done through the assistance of development institutions as county councils, NGOs, community organizations and the central government.
2. The operators should be assisted to form a strong umbrella association within the divisions with route sub-associations according to their routes of operation. The associations, should have strong regulations governing their activity as operators' identification details, mode ownership and route of operation. The operators should have routine supervision by the leaders in order to identify and stop illegal operators.
3. There is a need to train the operators on business management particularly on savings of their income. Such a move can help them save for maintenance and purchase of their vehicles and improve their operations in future. On the other hand, investment in other income generating activities will help them to diversify their sources of

income which will act as a security for their business.

4. Because of the disorganization of the activity, the operators have no other facility for identification by the customers other than their modes. For easier identification, the operators should be assisted to acquire uniforms with their routes of operation and the registration number of their bicycles indicated. This will on the other hand minimize the number of illegal operators, and also act as an incentive to improve their services.
5. For easier and faster services by the operators in goods transport, there is a need for them to open freight offices in the market centres and along the roads from where one can pick or send a good to a given destination.

Technical issues

The operators also sited such problems as lack of large carriers/racks for both passengers and goods and faster breakdown of new models of bicycles. Because of these problems, the local jua kali artisans had started fabricating some of the bicycle parts which the operators consider to be suitable and strong enough for the nature of their operation.

1. There is a need for the government and the NGOs promoting the jua kali and rural transport sector in the region to assist the artisans in designing the parts using the locally available materials that are affordable to the operators.
2. New models of the bicycles that can transport passengers together with their light goods should also be designed.

This will save the operators and passengers the cost of hiring another operator to transport the clients' goods.

Traffic management

Proper traffic management encourages efficiency and minimizes accidents. In the Nyando/Kadibo off-road transportation, it was found out that there is normally movement conflict between the matatus and Ngware-ini operators.

1. There is, therefore, a need to assist the operators particularly the Ngware-inis by setting their parking and loading terminals next to the road-sides and market centres where they collect and unload their passengers and goods.
2. Since the Ngware-ini operators offer same services with the matatus on the same routes, ways and means should be worked out to harmonize their activities. Some seminars and workshops should be organised for the operators for teaching them on traffic rules, and how they can coordinate their activities since they are complementary to each other. Currently there is a stiff competition and lack of cooperation between them.

Routine Roads Repair

The routes on which the Ngware-ini operates should be repaired by the Rural Access Road Programme (RARP) Department in collaboration with the transport mode operators within the region. The RARP already have the capital equipment but sometimes lack money for fuel.

A local joint passenger and goods transport modes operators

board can be set to collect and manage the funds for fuel. Taken that each Ngware-ini operators' contribute Ksh. 10 daily (Ksh. 300 monthly) through their associations, they can manage to raise Ksh. 12 000 per month which can be used to transport muram that can repair for a distance of not less than 3km. If the other nodes operators (matatus and tractors) contribute the same, then in a month's time a distance of 9km can be covered.

However, the operators' contributions should also be boosted by the funds allocated to the Ministry of Public Works for such roads. The County Council should also use cess funds to supplement these other efforts.

Credit Schemes

In order for the operators to get their own modes, credit should be advanced to them. The credit can be advanced by banks and NGOs through their associations which should act as their guarantor. Since starting the operation do not much working capital, the credit can be a bicycle model of the operators choice. However, they should be given a grace period of not less than 4 months and pay the loan at an average interest rate of 15%

	Income	Expenditure
Monthly income	Ksh. 4500	
Repair cost		Ksh. 300
Loan repayment		<u>Ksh. 675</u>
		Ksh. 975
Total expenditure	Ksh. 975	
Net Income	Ksh. 3525	

per year. This rate will be fair enough in that the operators

can pay it even during the business fluctuations.

Taken that the average cost of a bicycle is Ksh. 6000 (loan) at the given interest rate, the operators can repay the loan for a period of nine months and still remain with a net income of Ksh. 3525 per month.

Hire-Acquire Centres

There is also a need to assist the operators by the Local Authorities and NGOS start their hire-acquire centres from where the non-owner operators can get a bicycle at a given fee. The centre will also assist even owner-operators who may be having more than one transport needs in a given day. However, the centre should not limit its scope to operators alone but can extend its services to the non-operators willing to hire the nodes for specific journeys for a given period of time. The incomes generated from the hire-acquire centres can be used in maintenance of the bicycles and will on the other hand increase their income.

The centre can be started by operators having more than one bicycles donating their modes for a given period while the others contributing the working capital. If the operators can donate 10 bicycles hired out at Ksh. 70 per day then in one month the centre can generate Ksh. 21,000. This can be used to buy some 5 bicycles for the centre which can be generating approximately Ksh. 11,000 per month.

Policy Issues

Insurance Cover

Since the operators are carrying out the activity as public transport modes, long term plans should be made for operators to insure their modes and passengers lives. This will be in the process of regularising the activity and encouraging users' confidence in them in cases of accidents.

Employment creation

The government should fully support the activity in order to attract young people out of school who can not be able to get formal employment. This can be done by giving loans to the youth groups in form of bicycles a part from other facilities.

There is also a need to encourage local enterprises fabricating bicycle parts by availing credit and necessary training to them. These steps will lead to the creation of more employment in the operation of the Ngware-inis.

Rural Transport Planning.

The government transport policy support the use of non-motorised forms of transport and their incorporation in the transport planning process. However, the focus has been urban based other than rural areas. On the other hand, rural transport planning has been mostly concerned with the roads and motorised modes. Observation and studies have shown that, lack of consideration of all modes in transport planning can lead to inefficient transport system. There is a need by the rural

transport planners to consider all modes when collecting transport data, designing transport facilities and making recommendation of suitable modes for rural transport.

The recommended modes should be those that needs little investment but can have greater impact in terms of the improvement of the transport efficiency.

SELECT REFERENCES

- Adera, B. A. 1991 Ecological and Socio-economic Factors affecting Sorghum production in Nyando division, Kisumu District. BA Dissertation, University of Nairobi.
- Agate, E 1983 Footpaths: A practical consideration. Wembley Press, Wallingford, UK.
- Barwel & Howe 1979 Appropriate Transport Facility for The Rural Sector in Developing Countries in UNIDO ; Appropriate Industrial technology for rural areas: monographs on appropriate Industrial technology No 2, UN New York.
- Barwel et al 1985 Rural Transport in Developing Countries. IT publication, London.
- Barwel, I. 1983 Local Level Rural Transport In Sub-Saharan Africa. IT Tranaport Ltd, UK.
- Beenhaker, 1987 Rural Transport services: A Guide to Their Planning and Implementation. IT publication Limited London.
- Bowa, O. 1987 The role of informal sector in the economic development in Kisumu District: A Case study of rural service centres. MA Thesis University of Nairobi.
- Doran J. & Njenga 1982 Cycle and Trailer Hire-Acquire Centres in Lindi and Mtwara in SouthTanzania. IT, Kenya.

- Gatigwa, G. 1983 The viability of Hand-carts As an Alternative Mode of Transporting Goods in Nairobi. M.A. Thesis, University of Nairobi.
- GoK 1984 Kisumu district Development Plan. Government Printer, Nairobi.
- ____1970 National Development Plan. Government Printer, Nairobi.
- ____1994 National Development Plan. Government Printer, Nairobi.
- Hathway, G. 1985 Low-cost vehicles: Options for moving people and goods. IT Publications, London.
- Hindson, J. 1983 Earth Roads: A practical guide to earth road construction and maintenance. IT Publication, London.
- International Forum For
Rural Transport and
Development(IFRTD) 1994 First Regional Meeting of Experts in Anglophone Africa, Lilongwe 8-11 Nov Vol. 1 Proceedings of the Meeting March 1994.
- Kaira, C. 1980 Transportation Needs of the Rural Population of Developing Countries: an approach to Improved Transport Planning in Barwel. I. et al(1985) Rural Transport in Developing Countries. IT Publication, London UK.
- Kimani, B. K. 1990 Transportation Problems and Their Impact on Agricultural Development: A Case Study of rural access road programme. Ol Kalau Division. Nyandarua District. M.A. Thesis,

University of Nairobi.

- Madungah, J.K. 1975 The Role of Roads in Rural and Regional Development in East Africa: A Case study of Kenya and Uganda. M.A. Thesis, University of Nairobi
- Malberg-Calvo, 1992 Intermediate Means of Transport, Women and Rural Transport in Eastern Uganda. IT Transport Ltd, UK.
- Njenga, P. R. 1981 The role of Donkey mode of goods transport in Limuru. M.A. Thesis, University of Nairobi.
- Obiero, S. V. 1978 Feeder and Access Roads Planning in Rural Development: A Case Study of Busia District, Kenya. M. A. Thesis University of Nairobi.
- Ocharo, A.O 1977 The Role of Rural Transport Systems in Agricultural Development: A Case Study of South Nyanza District, Kenya. M.A. Thesis, University of Nairobi.
- Onyiro G. 1979 The Problem of Pedestrian movement in The Central Area of Nairobi M. A. Thesis University of Nairobi.
- Otieno M. K. 1983 The Role of Non-motorised mode of transportation: A case study of hand-carts operation in Kisumu Municipality M. A. Thesis University of Nairobi.
- Rukunga, N. 1990 The viability of bicycles as an alternative mode of transport in Nairobi. M. A. Thesis, University of Nairobi.
- Salkield, 1953 Road making and Road using. Sir Isaac Pitman

& Sons Ltd. London.

United Nations

Industrial Development

Organization.

(UNIDO)1979

Appropriate Industrial Technology For Low-cost transport for rural areas. Monograph on appropriate industrial Technology, No.2, UN, New York

World Bank 1976

Investigative Survey on Appropriate Transport and Farm Mechanization Systems for Small Farmers in Kenya. World Bank, Washington D.C.

APPENDIX

A STUDY ON THE ROLE OF BICYCLE IN NYANDO DIVISION

HOUSEHOLD QUESTIONNAIRE

Respondent's number.....

Sub-location.....
number.....

Sub-location

HOUSEHOLD DETAILS

Q1. How old are you?.....

Q2. What is your occupation?.....

Q3. What is your household size?.....

Q4. What is the average size of your land?.....acres

Q5. Which cash crops do you grow?

Cash Crop	calender year harvests	Quantity (sacks/debes)	Cost per Quantity	Annual Income
-----------	---------------------------	---------------------------	----------------------	------------------

Q6. Which modes do you use for transporting your harvest home from the shamba?

1.....

2.....

Q7. What are your other sources of income?

1.....

Q8. How much money do you get per month from these sources? Ksh.....

Q9. Which modes of transport do you own?

Vehicle Type	Bicycle	H/cart	W/barrow	Pickup	Car
--------------	---------	--------	----------	--------	-----

Number

Age(Years)

Year of New

purchase Second
Hand

Acquisition

Acquisition System:	1. Personal savings	2. Employer's gift
	3. Family gift	4. Hire purchase
	5. Farm produce	6. Other

Q9.a) If None, why have you not bought one?.....

Q9.b) If owned, which mode do you use frequently?

- 1.....
2.....

Q9.c) Which trips do you use it in?

- 1.....

Q10. If the mode owned is a bicycle:

Type Men Ladies Children
Ordinary Luggage

Number

b) Who are the usual users of the bicycle in the family?

- 1..... 2.....

c) When do they use it?.....

d) How many times can it be used in a day?.....

Q11. How far are the following activities located from home?

ACTIVITY MAIN MARKET SCHOOL RIVER HOSPITAL FARM
ROAD

DISTANCE FROM HOME

MODE USED

REASONS FOR USE

TIME TAKEN BY MODE USED

FREQUENCY OF VISIT(PER DAY/WEEK)

Q12.a) Have you ever used the Ngware-inis?

- 1. Yes [] 2. No []

Q12.b) If No, what are the reasons?

Q12.c) If Yes, when did you use them last?.....

Q13. What type of trip did you use it for?

.....

Q14a). Do you still use them?

- 1. Yes 2. No

Q14b). If Yes what are the reasons?

.....

Q14c). If Yes what are the reasons?

.....

- Q15. Which type of trips do you use them in?
.....
- Q16. How much do they charge you per trip? Ksh.....
- Q17. In future what other uses do you think Nware-inis will be suitable in?
1.....
- Q18. What problems have you found when using Nware-inis?
.....
- Q19. How can these problems be solved?
.....

A STUDY ON THE ROLE OF BICYCLE IN NYANDO DIVISION

OFF ROAD BICYCLE OPERATORS' QUESTIONNAIRE

PART A

Bus stage..... Time of day.....

Sub-location.....

Personal Data

Q1. Where is your home area.....

Q2. How far is it from here.....m/km

Q3. How old are you?.....years

Q4. What is the level of your education?

1. Primary [] 2. Secondary []

2. College [] 3. None []

Q5. Are you married?

1. Yes [] 2. No []

Q6. If Yes, what is your household size.....

Q7. a) Have you ever sought/looked for employment in any of the Kenya's towns or anywhere? 1. Yes [] 2. No []

Q7.b) If Yes, Which ones are these?.....

Town/Place Year

Q7.c). Did you get one? 1. Yes [] 2. No []

Q7.d). If Yes, which type of job was it?.....

Q7.e). What was your income per month/daily wage? Ksh.....

Q7.f). Why did you decide to leave it?.....

Ownership

Q8. Are you the owner of this bicycle?

1. Yes [] 2. No []

Q9. a) If Yes, how many do you own?.....

Q9. b) What do you use others for?

1..... 2..... 3.....

Q10. If owned, can you state the nature of acquisition?

1. Personal savings [] 2. Family gift []

3. Hire purchase [] 4. Bank cooperative credit []

5. Farm produce sales []

Q11. If No, can you state the nature of ownership?

1. Given by a relative [] 2. Hired []

3. Others (specify).....

Q12. If hired how much do you pay the owner per day/week/month?

Ksh.....

Q13. Why did you decide to start this business?

- 1.....
- 2.....

Q14. How long have you done it?

- 1.....days 2.....weeks
- 3.....months 4.....years

Q15. Do you practice it as a full time job or part time one?

.....

Q16. If part time, which other economic activities are you engaged in?

1.....

Q17. At what time of the day do you

- 1. start the business?.....
- 2. close the business?.....

Q18. Between which areas do you operate?

Origin	Destination	Time Taken	No. of Trips per day	Fare charge per trip
--------	-------------	------------	----------------------	----------------------

- 1.
- 2.

Q19. Approximately how much money do you get per day:

- 1: when there is more work? Ksh.....
- 2: when there is less work? Ksh.....

Q20. Averagely how many days do you operate this business in a month?.....

Q21. Does your passengers/customers normally have complaints?

- 1. Yes [] 2. No []

Q22. If Yes, what are the complaints?

.....

Q23. Do you still want to continue with this job?

- 1. Yes [] 2. No []

Q24. If yes, give reasons

.....

Q25. If No, give reasons

.....

Q26. Apart from passengers, do you normally transport goods?

- 1. Yes [] 2. No []

Q27 a) If Yes, Which type of goods do you mostly transport?.

.....

Q27 b) If No, What are the reasons?.

.....

Q28. Do you transport passengers with many goods?

- 1. Yes [] 2. No []

Q29. If Yes, what problems do you face at such periods?
.....

Q30. If No what are the reasons?
.....
.....

Q31. Do you have bicycle operators' association?

1. Yes [] 2. No []

Q31.a) If Yes, what benefits have you gained from it?

- 1..... 2.....
3..... 4.....

Q31.b) If No, what are the reasons?
.....
.....

Q31.c) Is it necessary to have operators' association?

1. Yes [] 2. No []

Q31.d) If Yes, of what help will the association be to you?
.....

Q31.e) If No, what are the reasons?
.....
.....

Q32. What transport problems do you face in passenger transportation on this route(s)?
.....

Q33. According to you, how can these problems be solved?
.....

Maintenance

Q34. In cases of your bicycle's breakdown, where do you seek for repair work?

1. I do it alone [] 2. Bicycle repairers around []
3. Else where(specify).....

Q34. What problems do you find with the repairer mentioned above?
.....
.....

Q35. Approximately, how much do you use for daily/monthly maintenance of your bicycle?

Ksh.....

A STUDY ON THE ROLE OF BICYCLE IN NYANDO DIVISION

PASSENGERS' QUESTIONNAIRE

- Interview Location.....
- Day of the week.....
- Q1. What is your destination?.....
- Q2. Where have you come from?.....
- Q3. Why have you decided to board a bicycle?.....
-
- Q4. What advantages do bicycles have over other modes on this route?.....
-
- Q5. How often do you use Ngware-inis?.....
- Q6. What problems have you noticed when boarding it?.....
-
- Q7. How much have/do you pay for this trip? Ksh.....

A STUDY ON THE ROLE OF BICYCLE IN NYANDO DIVISION

MATATU OPERATORS' QUESTIONNAIRE

Interview Location.....

Q1. How old are you.....

Q2. What is the level of your education.....

Q3. Are you married? 1. Yes [] 2. No []

Q4. If Yes, what is your household size?.....

Q5. Are you the owner of this matatu? 1 Yes [] No []

Q6. If owned, can you state the nature of acquisition?

1. Personal savings [] 2. Family gift []

3. Hire purchase [] 4. Bank cooperative credit []

5. Farm produce sales [] 6. Others(specify).....

Q7. Between which areas do you operate?

Origin	Destination	Time Taken	No. of Trips per day	Fare charge per trip
--------	-------------	------------	----------------------	----------------------

- 1.
- 2.

Q8. How many passengers do you need to fill your vehicle?.....

Q9. How long does it take your matatu to fill:

1. On market days []minutes
2. On other days of the week []minutes

Q10. Do you sometimes experience some delays in getting enough passengers to fill your mode? 1. Yes [] 2. No []

Q11. If Yes, what are the possible causes?.....

Q12.a) Do you co-operate in any way with the bicycle operators in the transportation of passengers? 1. Yes [] 2. No []

Q12.b) If No, What are the reasons?.....

Q12.c) If Yes, How do you cooperate?.....

Q13. What major transport problems do you face when transporting passengers?

- 1.....
- 2.....

Q14. According to you how can these problems be solved?

A STUDY ON THE ROLE OF BICYCLE IN NYANDO DIVISION

BICYCLE REPAIRERS

Interview Location.....

Q1. How old are you.....

Q2. What is the level of your education.....

Q3. Are you married? 1. Yes [] 2. No []

Q4. If Yes, what is your household size?.....

Q5. Are you the owner of the business?

1. Yes [] 2. No []

Q6. When did you start this business?.....

Q7. Where did you start it?.....

Q8. What influenced you to start it here ?

.....
.....

Q9.a) How many customers do you get per day?.....

Q9.b) Who are your usual customers?.....

Q10. What type of repair work do you normally do for them?

.....
.....

Q11. How much do you charge for such repairs?

.....
.....

Q12. How much does such type of repair work cost in Kisumu?
Ksh.....

Q13. a) Are you the owner of the shed/workshop?

1. Yes [] 2. No []

Q13. b) Is this a licensed shed/workshop?

1. Yes [] 2. No []

Q13. c) If No, how much do you pay per month/day/annum?

Ksh.....

Q14. What problems do you face in your business operation?

.....

Q15. How much do you get per day/month? Ksh.....

Q16. How did you acquire this knowledge?

.....

Q17.a). Do you train other/young people in this repair work?

1. Yes 2. No

Q17.b) If Yes, how many have you trained?.....

Q17. c) What level of education do most them fall in?.....