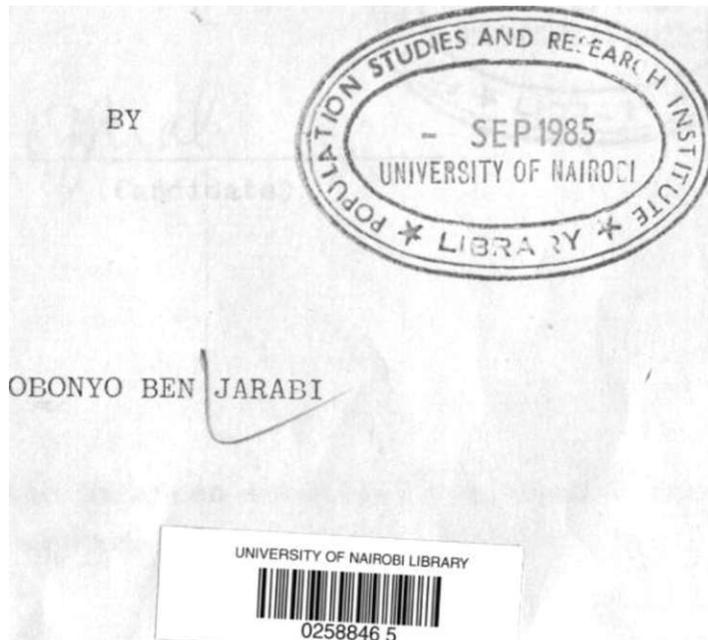




"INTRA-URBAN MOBILITY AND URBAN
TRANSPORTATION: A CASE STUDY OF
NAIROBI CITY, KENYA".



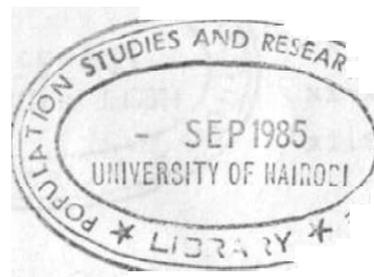
"A thesis submitted in part fulfilment
for the degree of Master of Science in
the University of Nairobi".

1982

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DECLARATION

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



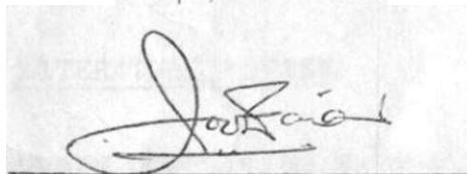
 V^J **A-**
(Candidate)

This thesis has been submitted for examination with our approval as University Supervisors.

Signed:


Prof. S.H. Ombi

Signed:



Supervisor

(Dr. J.O. Oucho)

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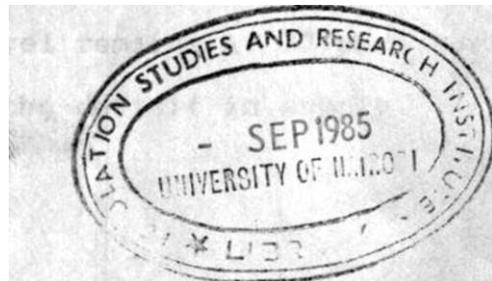
Urbanisation has, of recent, become a focal point for demographers, especially in developing countries. The concern is due to the tempo if not the level of urbanisation. The high growth rate of urban population is accompanied by many socio-economic problems among them urban public transportation. This study aimed at evaluating the extent to which supply of urban public transportation services has equalled demand (a result of the high urban growth rate) for such services in Nairobi. Kenya Bus Services (KBS) and Matatus were the public transport carriers used in the evaluation.

Urban growth rate in Nairobi has been at 5 ner cent and over per annum and is expected to continue at this rate up to the year 2000. With rural-urban migration ⁱ having an upper hand in this urban growth, it is estimated that at least 50 per cent of the urbanites in Nairobi will be migrants by 1985 and at least 40 ner cent by the year 2000. The nature of spatial population distribution is [»] unfair to the urban poor because they are pushed to the periphery hence forced to pay more for transport or walk long distances to and from their work places.

(vi)

Since 1934, KBS had monopolised the provision of public transportation services until 1973 when matatus were legalised to carry passengers through the Presidential Decree (1973). The coming of matatus has been seen as being inevitable since KBS had experienced deficits of 4.3 per cent and 2.2 per cent in their services provided in 1962 and 1972 respectively. However, matatus have brought some chaos with them: with no fixed fare-structure, rout@schedule and separate bays, matatu operations have been characterised by erratic random behaviour. They are seen in every corner of the city as they lure customers with the rampancy of overloading, overspeeding, obstructing other road-users and jumping traffic lights. In spite of their evils, the services provided by matatus, as they complement those from KBS, are indispensable, especially at peak hour periods.

With the daily ridership in the region of 250,000 passengers in 1981, matatus increase has had a negative effect on KBS operations whereby matatus had acquired 42 per cent of the market share in 1979. KBS has always looked at matatus as uncalled for competitors hence the campaign to annihilate them through reductions of fares on various routes.

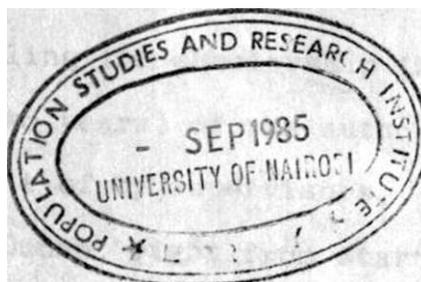


Proportion of potential passengers hence the level of demand has been commensurate with increase in population. Estimated at about 20 per cent of the total population in Nairobi in 1962, the level of demand rose to 25 per cent in 1972, 30 per cent in 1979 and 32 per cent in 1981. It is expected that by 1985, the demand level will still be 32 per cent. Of the people who use either KBS or matatus, the mixed usage of the two has resulted into KBS accounting for 60 per cent and matatus 40 per cent of the passengers carried (1981). Although the availability of services increased with the coming of matatus, the combined effort from KBS and matatus still falls short of the demand. Overcrowded buses, people stooping/hanging on matatus and buses/matatus passing non-stop at intermediate bus-stops are common sights during peak hours. While matatu services helped to reduce the deficit percentage from 4.3 in 1962 to 2.0 in 1972, this percentage increased to 3.5 in 1979 and 5.3 in 1981. The least growth rate in the number of matatus during the period 1979-1981 coupled with the overhaul in the KBS operations then, are among the causes for the rise in the deficit. With the assumption that the population growth rate in Nairobi remains at 5 per cent and that the demand level remains at 32 per cent of this population in 1985, the deficit in supply will rise to 6.1 per cent.

(viii)

Of the various implications that accrue from the attempt of marching supply with demand include: more and more people having to make most of their trips on foot, both roads and vehicles being overworked due to congestion hence accentuating the vulnerability of road accidents, many semi-and unskilled persons directly or indirectly being employed in matatu-related jobs hence a source of inducement for potential migrants.

Apart from the call for immediate attention on the effective control of matatus, improvements on traffic signals within the city centre, improvements on Juja Road and sections of Jogoo Road that are past their life-times, it is sincerely hoped that the situation in Nairobi will be used as an example so that proper planning and implementation of public transportation services in our smaller towns that are growing can avoid some of the mistakes.



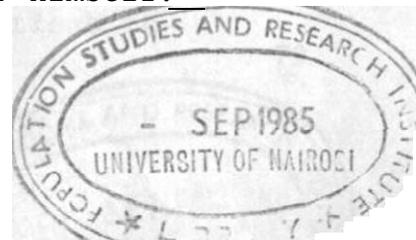
Urbanisation, as part of the development that is yearned for, has proceeded at such a fast rate in most developing countries that most of the urban plans are rendered null and void. As an aftermath of this process, multi-faced problems encounter urban planners as they venture to plan for the unknowns. Supply of sufficient and efficient urban public transportation services to the urbanites goes a long way in affecting an individual's life together with the state of the country's economy in general. With the urbanisation rate at 5 per cent and over per year in Nairobi, this study intended to consider the demand and supply of urban public transportation services in Nairobi since independence. Chapter coverage is given at the end of Chapter 1'.

It would be unfair to evade to accord due respect where necessary as it pertains to efforts other than the author's in acquiring the present state of this study. Many thanks to the Rockefeller Foundation through the . University of Nairobi for availing the scholarship that went into the sustenance (for two years) of the author at least. The precious foresight of my supervisors, Prof. S.H. Ominde and Dr. J.O. Oucho, right from start in terms of area of research, format of the thesis, style of writing and the constructive criticism towards

(x)

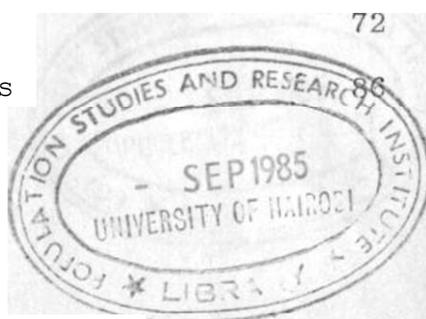
Piecing ideas together deserves more than a mere word of mouth for thanks. Among my sources of data, Nairobi City Council (especially through Mr. H.R. Munyendo in the Transportation Unit and Mr. Amunga in the Planning Department), Kenya Bus Services personnel particularly from the Research and Planning Office, Central Bureau of Statistics, Matatu Operators Association personnel and Matatu Operators in the City Centre were very cooperative in availing the necessary data. Credit on cartographic work goes to Mr. Sammy Okumu, while that on the clean typing is massed onto Mrs Mary Adarba and Ms Repina Makungu.

During the writing, useful discussions with Mr. J.M.T. Bukenya-Juuko (a colleague) proved very helpful. Of course there was the initial and continuous firework to initiate, instigate and eventually helped implement the incentive of undertaking such a study hence compliments go to Mr. Gregory K. Chybire. As of any errors in this study, none of the aforementioned persons should carry the cross if not the author himself.



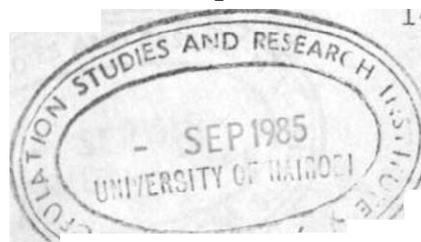
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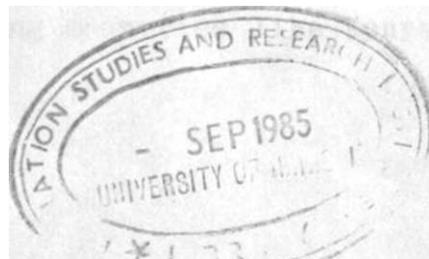


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CHAPTER 1

INTRODUCTION

Since 1775, a trend of accelerated growth in the world population has been marked, with the peak being currently experienced. Moving alongside the increase in the population, the crucial process of urbanization has been identified. Defined as the level of population concentration in urban areas, urbanisation which occurs in cycles has been with us for quite some time. Given that urbanisation is closely associated with the socio-economic development, the level and pace of the urbanisation process has been different for the developed and developing countries. Comparisons in the urbanisation process have been done between the developed and developing countries at different times to correspond to about the same socio-economic development levels. From these comparisons, a general agreement has been reached that the rate of change in the proportion urban in developing countries is not exceptionally rapid by historical standards but rather .it is the growth rate of urban populations that represents an unprecedented phenomenon i.e.it is the rate and not the level of urbanisation in developing countries that is higher than what was in the developed countries. Table 1.1 shows both the



percentage of the urban population together with the annual growth rates for the period 1950-1975.. It is quite clear that the proportion urban has remained quite low in the developing countries yet the urban growth rates are much higher than those of the developed countries. For example, Kenya's urban growth rates were more than twice between 1950-60 and more than three times between 1960-1975 to those of the developed countries.

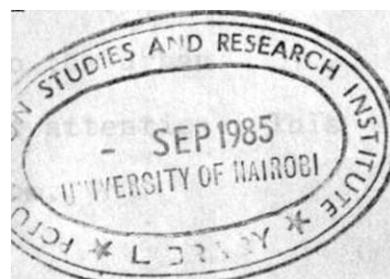
As for the Kenya case, the total urban population amounted to 216,240 or 5.1 per cent of the total population in 1948. This rose to 670,950 or 7.8 per cent in 1962 (Ominde, 1980). In an ILO paper on the 'Study Course on Social and Economic Development of Southern Africa', Ominde continues that the average rate of the urban growth between 1948 and 1962 was 6.6% per year as compared to the annual growth rate of total population of 3.0% per year. In 1969 the urban population rose to 1,082,437 or 9.9 per cent with the average intercensal urban growth rate having accelerated to 7.1% as compared to 1948-1969.

This high rate of urbanisation has become a major concern to many developing countries like Kenya.

TABLE 1.1 PERCENTAGE OF URBAN POPULATION AND AVERAGE ANNUAL GROWTH RATES, 1950-1975

Area/Region	Percentage Urban				Average annual growth rates (%)		
	1950	1960	1970	1975	1950-60	1960-70	1970-75
World	28.73	33.86	37.51	39.32	3.41	2.91	2.83
More Developed Countries.	53.61	60.46	66.81	69.78	2.50	2.05	1.73
Less Developed Countries.	15.76	20.95	24.94	27.17	4.86	4.03	4.03
Africa	13.72	17.56	21.93	24.31	4.67	4.77	4.70
Eastern Africa	5.32	7.37	10.56	12.22	5.47	6.16	5.66
Kenya	5.57	7.33	9.90	11.31	5.74	6.26	5.95

Source: UN: World Population Trends and Policies,
 1977 Monitoring Report, Volume
 Table 161 Page 265
 ST/ESA/SER.A/62 1979.



The concern is due to the fact that the high rate of urbanisation is associated with many social, economic and environmental problems. Rural-urban migration is one of the contributors of the urbanisation process. This movement is deemed to be the result of unjustified pattern of development that favours the urban especially in market-oriented economies (like in Kenya) where investments have increasingly concentrated in the few and rapidly growing urban areas. As a result of this biased development pattern, there occurs an influx of people to urban areas from the rural areas resulting into practical administrative difficulties of planning and implementing local public services in the face of unplanned changes in the population of users. African cities, many being the capitals or largest cities in their respective countries, are the centres of modernisation. Their primacy, the result of colonial history, is an inducement to the rural-urban migration. Nairobi is such a case in point in Kenya.

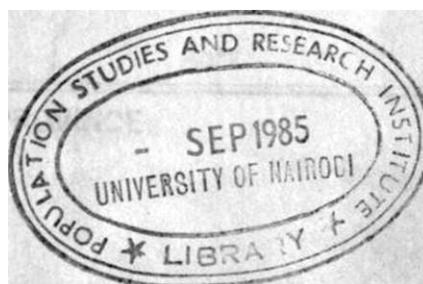
Among other services direly needed by the urbanites like housing, health, education, water, the provision of public transportation to the urban population in Nairobi seriously needs attention. This study addresses itself to this problem.

1.1 THE STUDY AREA

1.1.1 Geographical Background:

From North to South, Nairobi stretches between 1°35's and 1° 50's whereas from East to West, it lies between 37° 10'E and 36° 40'E. Today, Nairobi occupies an area of 693 square kilometres. The land rises to about 1676m at the city centre to 1905m above sea level to the north-west of the Central Business District. Figures 1.1 and 1.II show the location of Nairobi.

Nairobi was founded in 1899 as a transportation centre on the railway line to Uganda but it later became an administrative centre. A small Indian Bazaar had sprang up by 1900 and in the same year, the Nairobi Municipal Regulations, which defined the township area were published. The road network in the Central Area, as we know it today, had been established by 1906. In 1919 Nairobi became a Municipality and the municipal boundary was extended. Further boundary changes came in 1928. In March 1963, new boundaries for Nairobi were drawn up as a result of the recommendations of the Regional Boundaries Commission Report. ?



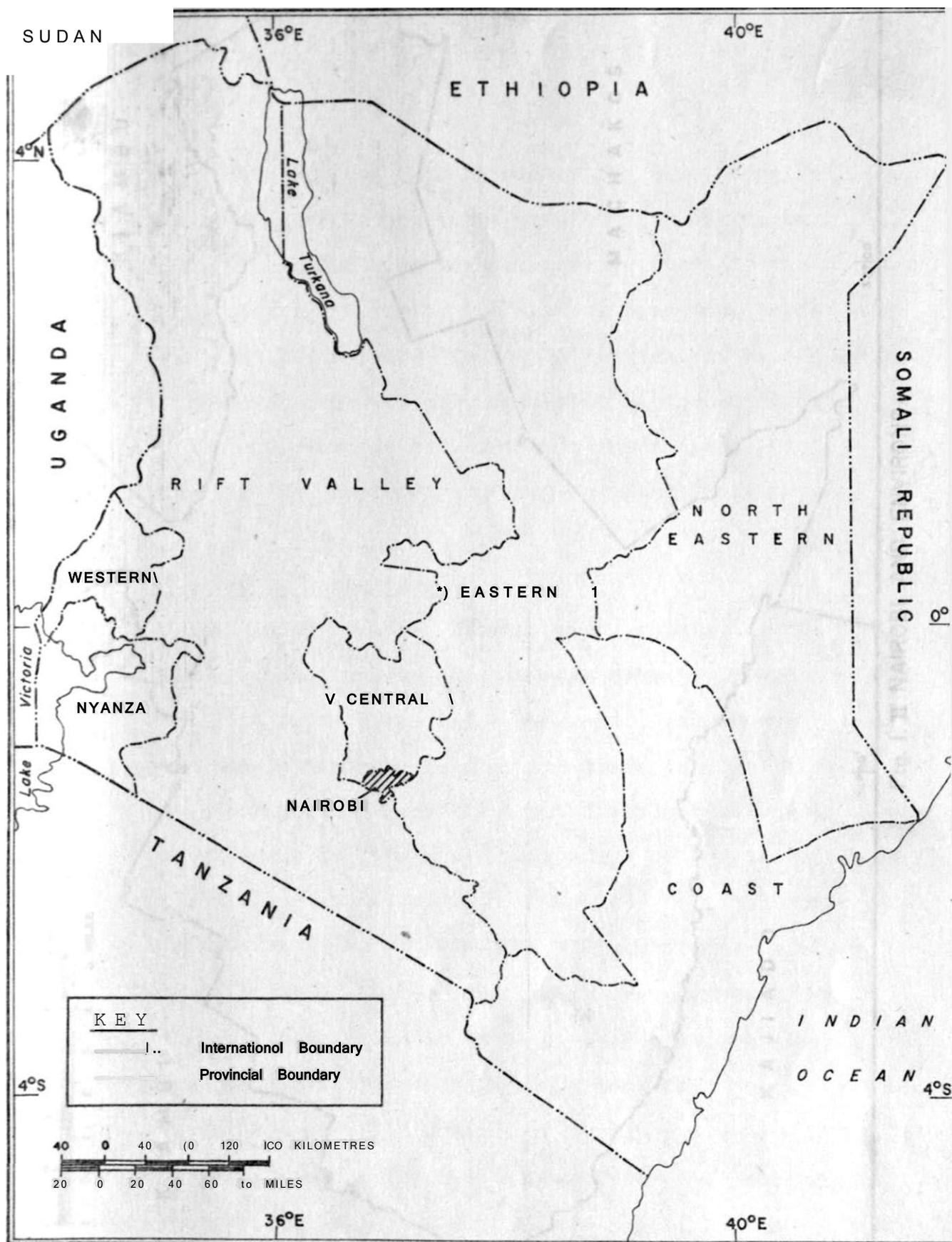


Fig. 1.1 KENYA:NAIROBI PROVINCE.



Fig. 1 H NAIROBI AND ENVIRONS.

Before this, Nairobi became the first town in Kenya and East Africa to be granted city status in 1950. The boundaries were further extended in the 1970s. Since its early growth, the various functions have developed and expanded to the extent that it has achieved an over-whelming dominance in the political, social and economic life not only for Kenyans but also for the people of the whole of East Africa.

1.1.2 Demographic Background

Founded in 1899, Nairobi had a population of 4,300 persons in 1902 and this has grown to about 1 million persons by 1982. Table 1.1.2(a) shows such population numbers over the years together with the corresponding growth rates. The fluctuations in the table up to 1962 could be assumed to be the result of the haphazard headcounts of Africans that were used at the time. Since 1970, the growth rate has been steady at about 5.3 per cent per year suggesting that the urban population is doubling approximately every 10 years. Heterogeneity is one aspect that characterises Nairobi's population consisting mainly of migrants from the rural areas. The 1969 census shows that migrants constituted 75.8 per cent of the population in Nairobi in that year; the trend has not changed much as the composition was 74.4 per cent as migrants by the 1979 census. The distribution of the population

Table 1.1.2(a)

POPULATION OF NAIROBI, 1902-1980 AND THE
GROWTH RATES.

Year	Population (000)	Growth Rate (%)
1902	4	8.9
1920	20	5.0
1930	33	7.3
1962	344	5.6
1969	509	4.8
1970	534	5.8
1971	566	5.3
1972	597	5.2
1973	629	5.3
1974	663	5.4
1975	700	5.0
1976	736	5.3
1977	776	5.3
1978	818	5.4
1979	863	5.6
1980	913	

Source: Central Bureau of Statistics, Ministry of
Economic Planning and Development.

is rather uneven over the whole urban centre. The North and West of the Central Area are predominantly occupied by high income earners with low densities of population while the South and East are areas of very high densities with middle and low income groups. The majority of Nairobi African residents occupy the high density residential areas to the East and North-East of the city centre, usually referred to as Eastlands. The densities span from as low as 94 to as high as 44,000 persons per square kilometre as per the 1979 census. **Figure I.Ill** shows the sub-divisions of the densities.

1.1.3 Suitability of the Study in the Study Area

Nairobi being the national capital and a primate city at that, houses almost all the Government and business functions of the country. It is also at the hub of the transportation network for the rest of the country. These factors have promoted the superiority of Nairobi as an urban centre with very large numbers of people moving in. Among other services, provision of public transportation services is starting to present an acute problem as concerns the urban poor and the general efficiency of the transportation system. The suitability of the

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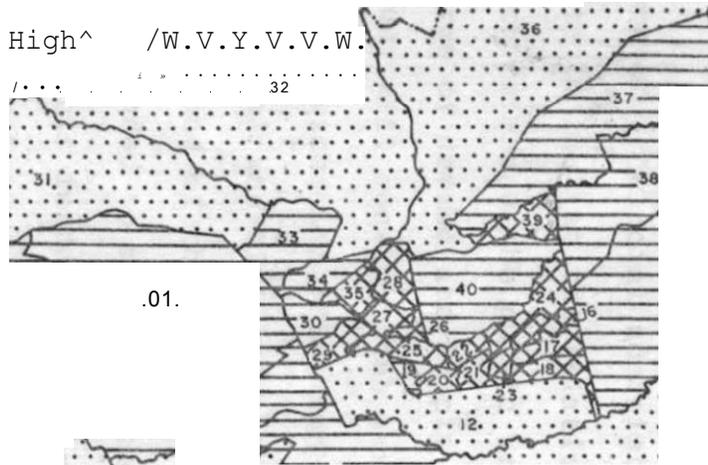
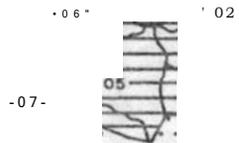
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KIAMBU



1° 20' 36°

V.

KAJIADO

W A R P S

14 EMBAKASI	33 PARKLANDS	18 MAKADARA	37 RUARAKA/
15 OANDORA	34 NGARA WEST	19 KALOLENI	KASSARANI
16 HARAMBEC	33 NGARA EAST	20 MAISHA -	38 KARIOBANOI
17 LUMUMBA	36 ROYSAMBU	MAKONGENI	39 MATHARE

40 EASTLEIGH 36° 15'

K I A M B U

zr.

W A R O S	
01 KILIMANI	21 MBOTELA
02 KIRNGEMI	22 BAHATI
03 RIRUTA NORTH	23 MARINOO
04 RIRUTA SOUTH	24 UHURU
09 WAITHAKA	29 MUTHURWA, SHAURI MOYO, KAMUKUNJI
06 UTHIRU/RUTHIMITU	26 PUMWANI
08 KAREN/LANGATA	27 Z IWANI/K ARIAKOR/STAREHE
08 KIBERA/W000LEY	28 PANOANI
10 GOLFCOURSE/NAIROBI	28 CITY SQUARE
11 NAIROBI/WEST/SOUTH	30 NAIROBI CENTRAL
12 INDUSTRIAL AREA	31 SPRING VALLEY
13 MUGUMOINI	32 KARURA

37° 00'

Fig. I. IK NAIROBI ^POPULATION DENSITIES. (1979 CENSUS)

study in Nairobi is viewed in terms of trying to solve an already existing problem (lack of adequate/efficient transportation services) together with suggesting possible strategies in other smaller urban centres such that they do not experience the same problems.

1.2 NATURE AND SCOPE OF THE STUDY

Taking Nairobi as the built-up part of the present provincial administrative area, the study aims to look at the relationship between the urbanisation rate and the public transportation system in terms of demand and supply of these services. The study will consider the services provided by the Kenya Bus Services Ltd (KBS) and the Matatus only due to financial and time constraints. Though the historical background of the KBS might be considered, the study is intended to mainly concentrate on the post-independence era. This is due partly to the fact that the matatus emerged in the early 1960s and partly because the rate of urbanisation rose as more people moved to Nairobi since the pre-independence restrictions for people to move to urban areas were lifted after independence.

1.2.1. Statement of the Problem

The high rate of urbanisation in Nairobi has resulted in increased demand for public transportation services. An evaluation of the extent to which the provision of public transportation services has marched the demand for such services, since independence, is the core of the study. In an attempt to assess the demand and supply of the public transportation services in Nairobi, the study has the following objectives.

1.2.2. Objectives

- i) to examine the urban population trends in Nairobi since independence. Since urbanisation receives its share from both rural-urban migration and natural increase of the urban population, it would be important to ascertain the extent to which each of these two contributes to the rapid growth of the population in Nairobi.

- ii) to determine the rate at which the urban public transportation services have been growing (especially after independence) - concentrating on the KBS and the matatus .

- iii) to analyse how the matatus and KBS have attempted to cope with the demand of the urban population for public transportation services.

- iv) to assess the practical implications that accrue from the above attempt. The problems that are social, economic and environmental affect individuals, the City Council and the Central Government at large. Alongside the assessment, suggestions and if possible recommendations as per what should be done to ease the problems will be cited.

- v) to suggest ways and means of improving the situation in the future.

1-2.3. Research Hypotheses

Although absolute numbers of persons in the population are important, the rate of change of these numbers is even more important for comparative reasons. So the rate of urbanisation will be one basic variable just like the rate at which the KBS and matatus have been growing together with the growth rates of passengers in both the buses and matatus will be.

It is assumed that there is a direct relationship between the rate of urbanisation and the rate at which public transportation services have been/are provided. It is postulated that "The high urban population growth in Nairobi, especially a result of rural-urban migration, has yielded demand for urban public transportation services that cannot be met by the available supply of such services". It is further hypothesised that

- i) The high urbanisation rate of Nairobi has been largely the result of the rural-urban migration other than due to the natural increase of the urbanites.
- ii) Nairobi's current high level of urbanisation will still continue in the near future.
- iii) The transportation services provided by KBS have been adequate to the demand resulting from the high rate of the urban population growth.
- iv) The emergence and continued increase of matatus has had a negatively adverse effect on the operation of the KBS.
- v) With the present and expected trends of urbanisation, the combined services from KBS and matatus still fall short, and will continue to do so, of the urban public transportation demands.

1.2.4 Significance of the Study

The importance of transportation can not be under-estimated since it pertains to the general process of development of an area - the movement of people to avail their services to the economy is one such particular aspect of the transportation that is crucial.

Nairobi being not only the hub of the economic activity in the country, it is also the focal point of the transportation network for the rest of the country. Having an inefficient transportation network will not only negatively affect the activities of the residents but it may also adversely affect the production efficiency of other areas in the country that are linked with Nairobi. The decentralisation of the urban areas as a policy adopted by the Central Government is a testimony to the problems encountered due to the urbanisation process. Provision of public transportation services is one of such problems, both to the City Council and the Government. The relevance of the study is considered along the following lines:

The improvement of public transportation services will provide some relief in reducing the consumption of petroleum by vehicles. A possible source of traffic congestion goes

in line with the government's effort to save/conserve energy given that oil accounted for 13 per cent of the total imports in 1979 (World Bank, 1980).

The rapid growth of urban areas has caused urban boundaries to expand significantly. This expansion seems to be negatively correlated to the transportation needs of the urban poor as they are pushed to live on the peripheries yet they need the public transportation services most. The transportation needs of the urban poor are real, pressing and hence call for special attention.

The rate at which the Nairobi City Council (M.C.C.) generates its revenue for the expensive exercise of road construction and maintenance is lagging behind the demands imposed on it.

by themselves, consume a lot of space and may vary much needed in the future. Provision of housing is already an issue in the City. Many points on the road network are approaching saturation levels during peak demand periods.

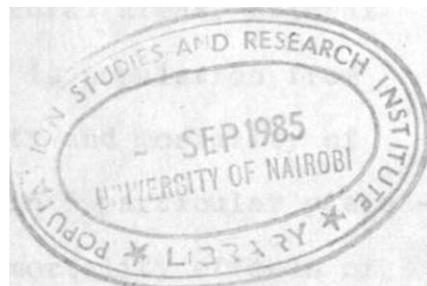
Due to the above facts and some others that are bound to crop up as the problem intensifies, it seems quite logical that it might be the high time the attainment of significant improvements in urban transportation were effected now at a relatively moderate cost.

Definition of important terms:

Many of the words to be used in the study are simple and clear in meaning except for a few that may warrant a clarification as per the sense in which they are used in this particular study. Following are the definitions of the few terms that may need clarification:

Intra-urban:

As opposed to inter-urban which is taken to mean the interaction of activities between two or more different urban areas, intra-urban will be used in this study to refer to the activities within a particular urban area. In this case, the activity is transportation in Nairobi City.



Mobility:

Although mobility may be looked at as a movement of people similar to migration, the study considers mobility as a commutative activity within the City of Nairobi. It is referring to the daily travelling to and from the city, work, school etc especially by public means.

Urbanisation:

It refers to both the levels of population concentration in urban areas and the tempo of change in population concentration. This is different from urbanism as the latter is taken to mean "a way of life" associated to urban areas.

Rural-urban migration:

It is the movement of persons from the rural areas to the urban areas involving a sustained or permanent stay in the place of destination.

Natural increase:

Unlike the increase in population due to the incoming migrants from the rural areas, natural increase refers to the increase in population from the combined effects of fertility and mortality of the people originally residing in a particular place - in this case the fertility and mortality effects of the urbanites in Nairobi.

Transportation:

Transportation as used here means road transportation and more strictly the movement of people as opposed to the movement of goods or flow of information and ideas which is generally referred as communication.

Demand/Supply:

When a person wants something sufficiently to be prepared to pay for it i.e he will offer an inducement to any supplier prepared to supply it, he is said to 'demand' the good/service. The demand for a good or service is therefore that quantity of the good or service which people are prepared to pay at a certain price. Indeed this is under the assumption that the consumers of the good or service are rational beings who are out to derive maximum satisfaction from the combination of this particular good/service and some others that they consider necessary. Along the same lines of rationality, a supplier will go ahead to supply the good/service so long as he has enough people prepared to pay at a certain price without him losing.

Matatu:

The post-independence era witnessed the emergence of small motor-vehicles that were illegally used as public passenger carriers in Nairobi. With time, these vehicles were nick-named "Matatu" due to the inducing low thirty cents, flat rate fare, the passengers were charged per trip. Under the Presidential Decree of June 1973, all motor vehicles of less than 3 tons tare weight were exempted from operating with the Transport Licensing Board permits as passenger carriers. This decree has covered the matatu operations up till today in Nairobi and elsewhere in Kenya. Today, the term 'matatu' covers a broad range of informal, unregulated public transportation services provided by private owner-operators and small fleet owners: they complement the Kenya Bus in trying to meet the demand for the services.

1.2.G- Methodology

Since there was not much in terms of data (especially for the transportation aspect) for this study, the bulk of it had to be collected from the field. Together with the literature that is reviewed in Chapter II, secondary data that was useful to this study emanated from such sources like the Nairobi

City Council, Central Bureau of Statistics, Kenya Bus Services Limited, Mazingira Institute and Matatu Associations. Questionnaires were employed to provide the essential primary data.

Pilot Survey:

A pre-test of the intended questionnaires provided very helpful cues to the survey. This was in terms of the context of the questions, the structure of the questions and the precision of the responses expected. It also revealed the difficulties involved in having the audience of particularly the matatu operators. To overcome these handicaps, help was sought from the affiliated Matatu Associations whose cooperation came in handy to administer the questionnaire to some of the matatu operators. A review of the questions was done to eliminate 'sensitive aspects (but not very crucial for the study) like how much matatu drivers/conductors are paid monthly. In the final questionnaires, the questions had to be structured and closed-ended in order to obtain concise and precise answers.

Questionnaires:

A total of four different questionnaires were administered. They were to a sample of the general population in Nairobi, KBS personnel, Matatu Associations personnel and Matatu operators (drivers and/or conductors). While those to KBS and Matatu Associations personnel were administered personally by the author, two research assistants had to be engaged in the administration of those to the sample of the population and Matatu Operators.

Sampling Design:

Only two of the questionnaires (i.e sample of Nairobi population and Matatu Operators) called for sampling since they were concerned with large "populations".

' Sample of Nairobi Population:

It was necessary that a survey be undertaken to establish the approximate proportion of the urban population that not only requires but actually demands the public transportation services. A sample of 325 (0.04% of the total population, 1981) households who were interviewed was thought to be

representative of the total population given the time and financial limitations. Using the densities in various residential wards from the 1979 census, the total population was divided into high, medium and low-density zones. Each zone's aggregate population determined a percentage of its population to the total population. The relative percentage of each zone's population to the sample size (325) determined the number of households to be interviewed in each zone. The total number of households to be interviewed in each zone was divided by the number of residential wards to obtain a more or less equal number of households to be interviewed in each ward of each region. Stratified-random sampling was finally employed to get the individual households that were actually interviewed in each ward such that a total of 50, 170 and 105 households from low, medium and high-density zones were interviewed respectively.

Sample of Matatu Operators:

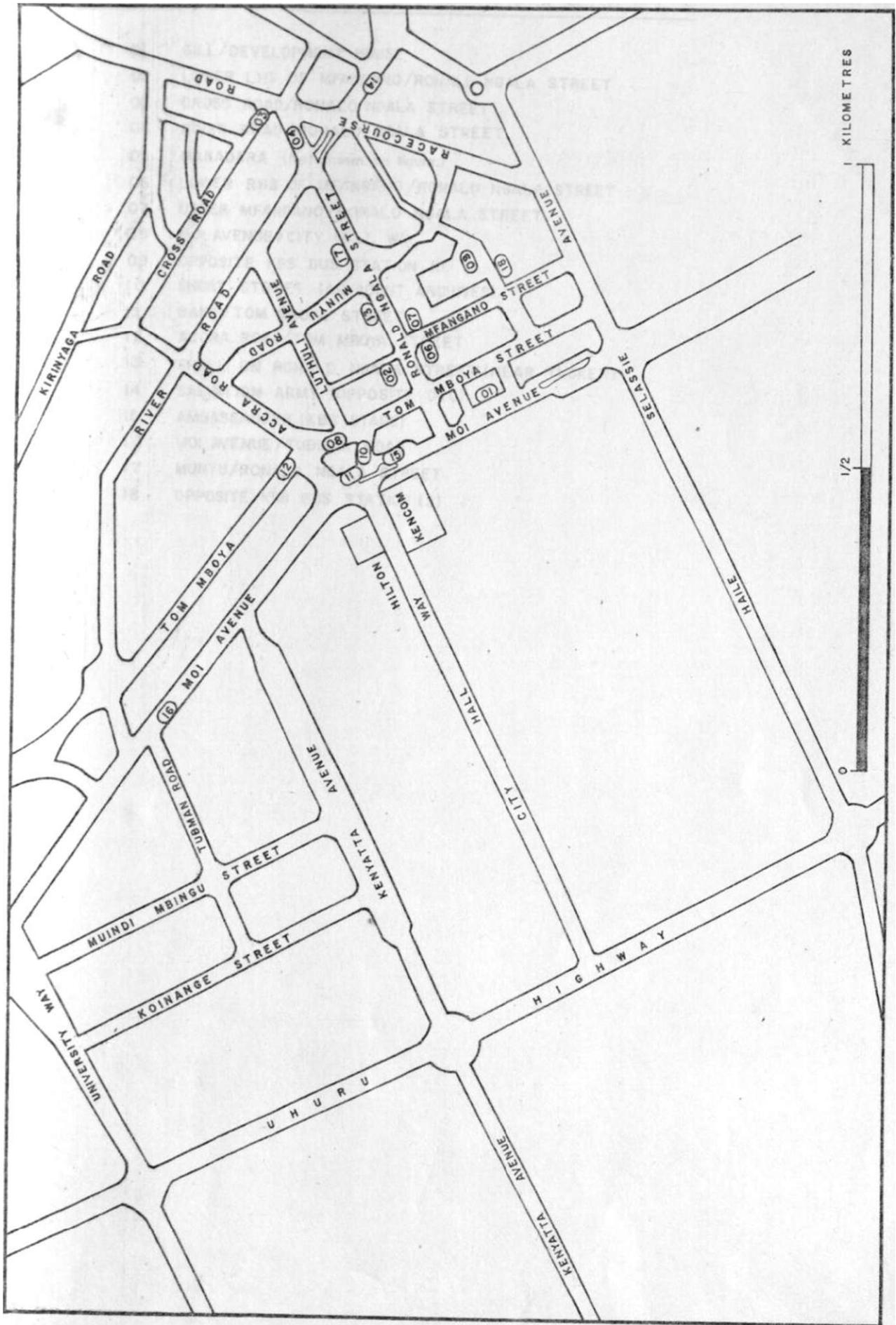
A sample of 295 operators was interviewed. All the matatu terminals within the city centre together

with the one at Makadara were located and each of these represented a stratum (Figure 1.2.6). Since knowledge of how many matatus pirated each terminal was lacking, it was decided to have an equal number of operators to be interviewed in each terminal according to how many different routes each terminal serves. A total of 100 operators (34% of the 295 interviewed), 20 from each, were interviewed from the busier terminals while 195 operators, (66% of the sample), 15 from each, were interviewed from the rest of the terminals. Stratified-random sampling was then used to determine the operators to be interviewed. However, due to non-responses in some cases, a total of 265 operators gave satisfactory responses (Table 1.2.6). A combination of those who never responded and those who gave vague responses amounted to 30 non-responses. Of the expected 295 responses, the survey received 90%.

•Major Research Difficulties:

The indispensable pressure due to time and scarcity of funds necessitated the study to concentrate only on KBS and matatus. The same reason goes in to

Fig. 1.26 MATATU TERMINALS.



M A T A T U T E R M I N A L S

- 01 GILL/DEVELOPMENT HOUSE
- 02 LOWER LHS OF MFANGANO/RONALD NGALA STREET
- 03 CROSS ROAD/RONALD NGALA STREET
- 04 RIVER ROAD/RONALD NGALA STREET
- 05 MAKADARA (Not shown on figure.)
- 06 LOWER RHS OF MFANGANO/RONALD NGALA STREET
- 07 UPPER MFANGANO/RONALD NGALA STREET
- 08 MOI AVENUE/CITY HALL WAY
- 09 OPPOSITE KBS BUS STATION (1)
- 10 SHORT STREET (ADJACENT ARCHIVES)
BANK/TOM MBOYA STREET
- I 2 ACCRA ROAD/TOM MBOYA STREET
- 13 SHELL ON RONALD NGALA STREET (NEAR TUSKER)
- 14 SALVATION ARMY (OPPOSITE OTC)
- 15 AMBASSADUER (KBS STAGE)
- 16 MOI AVENUE/TUBMAN ROAD
- 17 MUNYU/RONALD NGALA STREET
- 18 OPPOSITE KBS BUS STATION (2)

Table 1.2.6 MATATU OPERATORS QUESTIONNAIRE
^ RESPONSES OUTCOME.

Terminal	Expected Responses	Actual Responses	fr Of total
01	20	17	6.4
02	20	19	7.2
03	20	16	6.0
04	20	18	6.8
05	20	20	7.5
06	15	15	5.7
07	15	13	4.9
03	15	15	5.7
09	15	15	5.7
10	15	12	4.5
11	15	14	5.3
12	15	15	5.7
13	15	13	4.9
14	15	14	5.3
15	15	11	4.1
16	15	10	3.8
17	15	15	5.7
18	15	13	4.9
	295	265	<hr/> 100.1

Source: Author's Survey.

explain why the study did not exhaust all the facets of public transportation services in Nairobi, particularly as concerns the matatus.

Suspicion:

With lack of proper organisation and administration within the matatu operation, suspicion is the order of the day for the operators since they believe that the City Council or Government officials are always after them. It took a lot of effort from the Matatu Association officials to convince the operators to cooperate although this effort was sometimes met with a flat refusal to talk. •

Violence:

At times the suspicion could culminate into the suspect being manhandled. They would arrogantly come in a mob demanding to know what the whole exercise is all about. The author escaped physical assault three times from the operators during the survey.

Data Analysis:

With most of the information coming from the field, coding, editing and tabulations had to be done. Even the scanty information that the matatu operators parted with was governed by a high degree of inaccuracy. The matatu data that appears in this study has undergone various approximations after comparisons with data from various sources.

From the absolute figures, rates of growth for the population, KBS and Matatu fleet sizes and passengers carried have been computed and tabulated. The usage of these growth rates facilitated projections of the expected population, vehicle numbers and potential passengers to be calculated.

The absolute figures also went in to effect the simple, partial and multiple regression and correlation analysis in order to evaluate the relationship and influence between/among the variables. The employment of the growth rates, projections and correlation coefficients is expected to clearly develop the link between urbanisation and the provision of public transportation services.

Outline of Chapters:

Following is a short review of the expected chapters and the contents in each:

Chapter 1 gives a general introduction of the urbanization process in the world, then the Kenyan case and then the manner it has occurred in Nairobi particularly. Together with this, the study area, nature and scope of the study, objectives, hypotheses, significance of the study, definitions of concepts to be used in the study and the methodology used are covered in this chapter.

Chapter II is expected to concentrate on the literature review. The available work that has been undertaken related to this study will be outlined in detail so that the existing gaps can be identified in order that the study attempts to bridge them.

Chapter III will take up the urban population trends in Nairobi since independence. Natural increase and rural-urban migration as components of the urban population rates of growth will be discussed and an assessment done to determine which of the two is more important in the case of Nairobi.

Chapter IV will look at the public transportation services in Nairobi. Trends since independence for both KBS and Matatus and the nature of their operations will be considered.

Chapter V tries to relate the demand and supply of public transportation services by an evaluation as to how the KBS and Matatus have attempted to catch up with the demand for their services.

Chapter VI considers the implications that accrue from the effort to satisfy the demand for public transportation services. It also summarises the findings of the study and concludes by giving various recommendations.

CHAPTER IILITERATURE REVIEW

Despite the apparent importance of the relationship between the urbanisation process and transportation needs, very little has been studied as far as Nairobi is concerned. Literature on transportation in general is abundant but only that dealing with aspects relevant to this thesis will be presented. The aforesaid also applies to the general process of urbanisation. This chapter reviews literature on two aspects: namely, urbanisation and the nature of transportation systems especially in developing countries and Kenya in particular.

Studies by the United Nations (1980) show that an average annual growth rate of the urban population of 4.97% for Africa between 1970 and 1975 outstripped
3
any other of the major regions of the world. However, as concerns the contributions of the components of this urban growth, the United Nations (1973) says:

"The contribution of natural increase can not be separated from the contribution of migration. Part of the urban natural increase occurs among rural-urban migrants - for instance, it has been observed that the newly urban population in Latin America, which consists predominantly of young adults retaining typically high rural fertility rates, accounts for an important proportion of urban natural increase".⁴

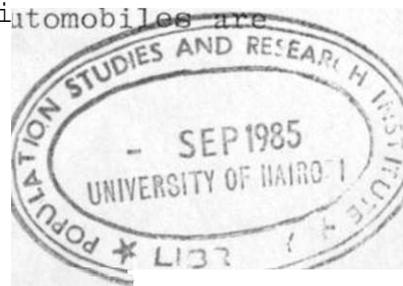
The above study estimated that the natural increase component for most Latin America was about 60 per cent between 1950 and 1960. On the other hand, it appears that in African countries about 60 per cent of the urban increase during the same decade was due to migration.

From the United Nations studies (1973, 1980) it is suggested that when economic growth is slower, the large majority of urban growth (perhaps two-thirds) is a result of the natural increase. However, it should be emphasized that African countries were poorly represented in the data set although one should expect migration rates to be higher where economic growth is more rapid.

In a paper on urbanisation, the World Bank (1972) believes that the despondency surrounding the task of ameliorating urban conditions in the developing countries arises primarily from the speed of urban growth and shortage of both human and financial resources. Since transport access is a pre-requisite to urban development, any deficiencies in urban transport facilities add substantially to the costs and difficulties of moving both goods and workers within and through the urban areas. As for the fate of the urban poor, the World Bank felt that for many years to come, the great majority of the city populations will, on account of their income level, have no option but to rely on walking, bicycles or some form of public transport.

This simply attests to what is currently happening as streams of workers, increasing every day, on foot to and from Industrial Area are a common feature in Nairobi.

The World Bank in the same paper suggests that since roads represent the largest part of transport infrastructure investment and private automobiles are



the most obvious cause of congestion, attention should be centred here. The balance between personal and mass transport, between vehicles and roads, should not only be at the heart of the urban transport problem but also the decisions taken regarding this balance will fundamentally affect the quality of urban life in the future. Thus

"The greatest scope for economising in urban transport and relieving congestion in the longer term is indeed in influencing the growth of the cities in ways which reduce the need for transport, particularly to and from the present Central Business and Industrial Districts with their already determined and usually insufficient and inefficient road network".

Apart from providing an analysis of the nature of transport systems in developing countries, the above study also outlines useful lines of action for the future to help avert transportation problems.

Preston (1979) is concerned with urban growth in developing countries and maintains that "many accounts falsely have the impression that rural-urban migration rates in developing countries, like birth rates, are high". Urban growth through most of the developing world results primarily from the natural increase of urban populations, he adds. Of the twenty-nine developing countries Preston studied, twenty-four had faster rates of natural increase than net-migration rates in urban growth. The mean percentage of urban growth due to natural increase for the twenty-nine was 60.7. Five show exception - Bangladesh, Puerto Rico, South Korea, Turkey and Argentina. The reason given is that these exceptions have achieved much higher levels of income per capita than the average developing country and/or have made unusually rapid economic progress. (Doubt is cast on the economic progress as far as Bangladesh is concerned). However, Preston's results pertain primarily to Latin America and Asia (except China) since data coverage of African populations was very poor but the Kenyan situation, presented later, suggests its inclusion in the list of exceptions.

As an illustration of the high urban growth rate, a special case of the city of Calcutta, India, is given below to hint, at the transportation problems that have resulted from urbanisation;^a

Sprawling slums, mountains of garbage, a heavily over-worked sewerage system, narrow lanes and the crawling pace of theykvercrowded public transport system have reduced Calcutta to urban chaos. Officials of the city say no major road has been built in the city, still flourishing as one of India's major trading centres, in nearly 50 years. The Minister for Urban Development in India says that Calcutta's problems are enormous and adds that only six per cent of the city's land area has been turned into roads. Calcutta's total population (1981) is estimated at nearly 11 million. About 2.6 million live in 3,000 officially registered slum areas. The traffic moves slowly - officials say the average speed is only about 10 km per hour - and tens of thousands of hawkers crowd the pavements leaving little room for people to walk. Many prefer to walk home but those who have courage, try to hang onto the incredibly overcrowded buses and trains. There is chaos as cars, buses, trains and rickshaws weave their way through the poky roads. Calcutta has 3,238 buses, 400 trams and a thousand taxis but the demand for surface transport is for three times that number.^Q

Though Preston's study hints at approximate levels of in-migration and natural increase, it fails to give definite rates for African countries and for Kenya in particular. It all the same provides a useful basis for comparing our experiences here with those in the outside world.

Breese (1966) says that the morphology of the city of Delhi - New Delhi, India, incorporates most of the features of urbanisation in newly developing countries; particularly in large-scale cities and those that have been exposed both to indigenous and colonial growth influences. One of the most noticeable features of large Indian cities is their combination of very high population density in relatively small areas and relatively low population density over other large areas: a vivid characteristic in Nairobi. Also part of the general picture of the large Indian urban area is the contrasting road and circulation pattern. The transportation "mix" (many modes of transportation - trucks, camel carts, bicycles, horses, donkeys, buses, rickshaws, pedestrians etc) in large

Indian urban areas further complicates circulation. This mix of modes of transportation involves travel at greatly varied speeds and virtual disregard for channelisation. Those who walk from place to place make the vast majority of trips.

Providing transportation facilities in cities in newly developing countries is complicated partly by the legacy of generally unimproved circulation systems that characterise many parts of these metropolitan areas. Nevertheless people do get from place to place, albeit with considerable inefficiency and for low income urban residents at considerable cost, the study concludes. Though the situation in Nairobi does not seem to be as bad as that in New-Delhi, the transportation mix of all vehicles, bicycles, 'push-carts' and pedestrians is already being experienced in Nairobi and may reach the same level as in New-Delhi if not checked.

Vasilevsky (1969) discusses the subject of transport geography and further outlines principles and criteria to be used in mapping transportation of capitalist and underdeveloped countries, among them Kenya.¹⁰ He continues to argue that population mobility is directly affected not only by the present-day economy, socio-cultural living standards and settlement patterns, but also by past conditions. That population mobility depends on the socio-economic system of a country links up with the profit-making competition being depicted by matatus and KBS under the free-enterprise kind of economic system. His general argument easily tallies with the existing conditions in Kenya where public transportation services are monopolised by the private sector whose major objective is to maximise profits.

The Kenya Government, in its current Development Plan for 1979-83, concedes that the rate of natural increase in urban areas in Kenya is at present considerably lower than in the rural areas.¹¹ This is not only because of better access to better social and economic amenities, but also because of the male dominance in the urban population structure. The main determinant of population growth in the urban centres is, therefore, migrations from rural areas leading to an urban growth rate twice the national average. This observation is in line with other findings by the United Nations cited earlier that rural-urban migration has an upperhand in the urban growth in Africa.

Before considering the Kenyan situation, Lagos city, Nigeria, is looked at from the African context of the urbanisation process and the resultant factors as far as transportation is concerned.

For all its faults, Lagos acts as a magnet for the rural poor of much of West Africa. Lured by the glamour of the big city and spurred by stagnation in their home villages, they come flocking here at the rate of 35 an hour, 300,000 a year. At its present rate of growth, Lagos - with an estimated population of 4.5 million (1981) - will hold 15 million by the end of the century. Among the problems, traffic jams, known locally as go-slows, can last for three hours or more. It has become a "city perhaps" - there is no certainty about most items. Workers have to leave home at 5 a.m. in order to get to work at 8 o'clock and close at 5 p.m. but do not reach home till 10 p.m. In an effort to take some of the pressures off Lagos, President Shagari is determined this year (1982) to start moving the federal government to Abuja, in the middle of this vast nation.¹² Whether or not this move succeeds remains to be seen but all the same, the already existing transportation problem in Lagos has to be solved.

Though the study was especially about Nairobi, the Nairobi Urban Study Group (1973) computed some projections for Kenya, rural Kenya, urban Kenya, Nairobi and other urban centres

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(Table 2.1). In the table, the group suggests that while migration will continue overriding the effect of natural increase in urban growth in urban centres as a whole and other urban centres apart from Nairobi, the reverse is true for Nairobi as a single urban centre.

Pertaining to the aspect of transportation in Nairobi, the Nairobi Urban Study Group (1973) had four major recommendations:***

First, restrictions be placed upon the growth of the present Business District and Industrial Area - decentralise the growth.

TABLE 2.1 NATIONAL POPULATION PROJECTIONS (000)

	1971	2000	CHANGE
Kenya (total)	11 671	31 209	+ 19 538
Rural	10 371	23 209	+ 12 838
Natural Increase			+ 16 565
Migration			- 3 727
Urban	1 300	8 000	+ 6 700
Natural Increase			+ 2 973
Migration			+ 3 727
Nairobi	585	2 880	+ 2 295
Natural Increase			+ 1 179
Migration			+ 1 116
Other Urban Centre	3 715	5 120	+ 4 405
Natural Increase			+ 1 794
Migration			+ 2 611

Source: Nairobi Urban Study Group; "Nairobi-Metropolitan Growth Strategy", Volume 1, Table 1, 1973.

Second, the movement by road be accommodated on a system of new and upgraded existing **roads**.

Third, the whole movement system be based on a policy of minimising the need for capital investment; by locating workers' housing near employment areas, by restricting the growth of car ownership and by the development of a cheap and efficient public transport service based on an increase in bus service and the establishment of special bus ways.

Lastly, the city council to establish an autonomous transport authority to control public transport operations and to increase its share to a controlling interest in the operation of KBS in Nairobi.

The group's economic analysis shows that there seems little difference in financial terms between the two alternatives of a busway and rail system. However, other factors have to be considered, for instance, provision of employment, the ease of administration and

operation, the extent of local experience in the provision and operation of such systems and the relationship between local resources and personnel, and the foreign exchange component and the need for expatriate personnel. It considered a public transport system based on the extensive use of buses on all-purpose roads. This together with articulated buses operating on a system of exclusive busways constructed solely for this purpose, as having overriding advantages over a system containing rail rapid transit.

The Nairobi Urban Study Group adequately analysed both the urbanisation and transportation aspects of Nairobi but no apparent attempt was initiated to relate these two aspects.

Taking a geographical analysis, Ogonda (1976)
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looked at transportation in the Nairobi area. He considered the services provided by road, rail and air. He found that by 1973, Nairobi had a population of 629,000 with a total number of 92,885 vehicles,

giving 147.7 vehicles per 1000 population and 1.7 buses per 1000 population. Due to this, there were problems of congestion of vehicles and difficulty in parking.

He recommends that polarisation of work places away from the Central Area should be effected and that new roads should be constructed or the existing ones enlarged. The study adds, that KBS operates beyond the city boundaries is attributed to the increasing demand from the public, good conditions of roads and generally lack of regular public services.

He assesses that on average, the KBS carry a total of 250,000 passengers on a normal week-day and in general, they (KBS) operate at maximum capacity despite matatu competition. He is of the opinion that due to the influx of people (most of them in the lower income bracket) into Nairobi after independence, the matatus sprang up since, unlike other means, they offered lower fares.

Though his study could not ascertain the number of matatus operating in Nairobi, it observed that despite competing with KBS, matatus complement the KBS services, particularly so when they operate beyond the city bus terminals. He took 15 as the average number of passengers per matatu with 1618.5 as the total number of trips made daily for all the matatus surveyed. From this then, they carry on average 24,277 passengers per day, hence their importance.

The treatment given to the KBS and matatus in the above study is not sufficient for this study as more rates of growth in the fleet size (both KBS and matatus) and passengers carried are essential.

A project on Urban Transport by the World Bank (1980) asserts that Kenya does not have a clearly

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defined urban transport policy. Among others, the factors below were considered to affect urban transportation: increased cost of oil and concomitant pressure on the balance of payments; rapid urban growth and the increasing spatial dispersion of urban population,' and financial restrictions on municipal finances for road construction and maintenance.

Since urban public transportation services are provided by the private sector in Kenya, it implies that the maintenance of an adequate supply of public transportation services will depend on the financial and investment incentives in the sector, which to a large extent is determined by Government Policy. The study adds that KBS has maintained adequate profitability throughout most of the period

since 1973 (since inflation) but this has required a number of fare increases. In the meantime, KBS did not expand its services significantly between 1974 and 1978; this is due in part to increased competition from matatus and also to financial constraints to expand the fleet and to renovate.

From the analysis of traffic conditions, the above project revealed that the major urban transport problems in Nairobi are: inadequate public transport service and quality; traffic congestion due to obsolete junction designs and inadequate signalization, insufficient road capacity in major road corridors and several key gaps in the road network; a decline in road and equipment maintenance standards due to inadequate budgets and obsolete facilities and equipment; lack of adequate pedestrian facilities and pedestrian safety; and inadequate access roads in several low-income neighbourhoods.

The number of urban buses operating in Nairobi in 1979 was of the order of 0.4 bus for every 1000 people in the city. With matatu, the corresponding service ratio was of the order of 0.6 bus"-equivalent for every

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1000 people. This is a pointer to the insufficiency of transportation services. Even using the 1970 data from World Bank Urban Transport Sector Policy Paper, Nairobi has significantly less capacity than other cities, for example Abidjan (1.7 per 1000), Bangkok (1.2 per 1000), Bogota (1.4 per 1000).¹⁰

Available evidence from the project indicates that bus-matatu competition is producing an economically efficient service specialised along lines of comparative advantage. Due to a smaller sitting capacity, the possibility of penetration services into low-income areas with constrained road networks, matatus can remain profitable while providing services on routes which KBS would probably lose money.

A project by the Nairobi City Council (NCC, 1980) on Matatu Operations in Nairobi has it that passengers use matatus as a means to travel irrespective of inherent

operational dangers.¹⁹ This is because the KBS is unable to meet peak hours' demand. The report adds that faced with high population growth, steady economic development, high inflation rate and high demand for transportation facilities, it is desirable to develop reliable and safe public transportation systems.

Matatu transportation system is an informal transport system which provides employment for the low-income groups of the population. The project assumed a positive approach to the problem of improving matatus with a view to do the following: First, making matatus an effective part of the public transportation system; second, ensuring that matatus will supplement and not compete the KBS; third, ensuring that the matatu operations continue to provide employment for the low-income group; fourth > ensuring that there will be a continuous operation of buses even after 1985, when KBS franchise expires; and last, ensuring that all safety factors in vehicle operation and maintenance are enhanced to the maximum.

According to the NCC, about 24 new vehicles came on the road per month between 1974 and 1976. The council's survey of 1979 indicates from the vehicle registration of all identified matatus that about 41 out of 1000 vehicles per each registration letter are used as matatus, each letter for example KRV 001-999 takes one month to complete. With this trend, it can be assumed that at least 500 new vehicles per year are used as matatus - thus about 2500 vehicles are expected to have been purchased as matatus between January 1980 and December 1984. A few of the matatu operators interviewed agreed that a matatu vehicle's life is a maximum of two and half years under the existing conditions, hence all matatus identified in the 1979 survey can be expected to be off the road by the end of 1983.

The project felt that matatus pose safety problems because of several reasons, some of which are that matatus overload so as to raise enough money to repay loans; the vehicles are unroadworthy because formal repair facilities are very expensive while the informal repair facilities are both semi-skilled and poorly equipped

It suggests that relaxation of loan conditions and improvement of informal repair facilities will increase safety in vehicles and on the road.

In an on-going study, the Mazingira Institute (1981) has embarked on a project "The Matatu Mode of Public

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Transport in Nairobi". An informal mode of public transport, the use and conservation of energy and feasibility of non-motorised vehicles for urban areas in Kenya will be examined. The main objectives of this study are to examine in detail the economic and performance characteristics of matatus for example, the number and type of vehicles routes, fleet size, travel speed, fare structure, fuel consumption etc. Capital, operational and maintenance costs, revenues and profit levels will constitute the economic analysis while the socio-economic profile of matatu employees, owners, drivers, conductors and users will also be analysed. Emphasis will be put on encouraging the use of public transport as opposed to private transport.

Mazingira Institute is aware that although the promotion of public transport appears to save energy as opposed to private transport, studies elsewhere have demonstrated that these energy savings begin to materialise only under certain conditions. These include housing, population density, relative location of housing and employment, street layout and related factors.

Another alternative to be studied is the use of non-motorised vehicles for urban transport in Kenya. The Mazingira Institute observes that bicycles provide a well tested and low-cost technology that can help to relieve both the transport and energy problems.

Unfortunately, over the past 11 years, the number of bicycles annually registered in Nairobi has decreased by over 84%. The goal is to develop a comprehensive implementation programme for expanded bicycle use in the city of Nairobi and this will be achieved by undertaking three projects, namely, the design of a pilot project, a study of the opportunities for the local manufacturing of bicycles and bicycle facilities and the development of safety measures and an educational programme for bicycle use in Kenya. Whether or not the idea of bicycle will catch up on the class-conscious Kenyan society remains to be seen.

It is clear from the various aspects of the review above that each study except one, concentrated on either transportation or urbanisation only. Even the Nairobi Urban Study Group that gave a detailed analysis of both aspects did so in isolation with no apparent effort to relate them. It is hoped that this study will provide the missing link between the rapid urban growth and the transportation services by relating the demand and supply of such services over the years.

Notes

- a The Standard, Thursday, 1st April 1982; An article entitled "Brim battle to save 'dying city'". The city's problems are gigantic and solutions not easy to find. Garbage is merely the most visible sign of the city's failing health. At places, roads are too narrow hence the fear that any digging might result in old buildings collapsing. Work was started on an underground railway system in 1972, and has progressed slowly as costs have mounted from 1.4 billion rupees (\$150 million) to six billion rupees (about £670 million).
- b Sunday Standard, 4th March, 1982; An article entitled "Lagos: The City of chaos and filth". The Lagos State Ministry of Environment recently appealed to the public to report cases of dead bodies found by the roadside instead of letting them remain there for days or even weeks. The appeal says a lot about the quality of life - or lack of it - in this sprawling, filthy and overcrowded metropolis where violent crime and the internal combustion engine exact a steady toll of unreported corpses. The Opposition Unity Party says that there remains little to be seen in Abuja (proposed new capital); it says the money earmarked for Abuja would be better spent on improving living conditions in Lagos, "perhaps city".

CHAPTER IIIURBAN POPULATION TRENDS IN NAIROBI

Urbanisation as we know of it today, can be viewed from two different angles. Some scholars and policy-makers look at the current rapid urban growth rates as fostering national processes of socio-economic development, especially in the poor and rapidly urbanising countries of the third world. Others believe the consequences to be largely undesirable and argue that such urban growth should be slowed down.

This chapter looks at the present form of urbanisation in Kenya and particularly in Nairobi. Natural increase of the urban population together with rural-urban migration as components of the urban population rates of growth will be discussed. Finally, an assessment will follow to determine which of the two components is more important in the case of Nairobi. After this treatment, we should be in a better position to consider the pros and cons of urbanisation alongside the two schools of thought given above.

Due to both the accelerated rural-urban migration and natural increase, Kenya's urban population is increasing at a phenomenal rate. Available data suggests that the total urban population is doubling approximately every 10 years. Kenya's urban population is, however, unevenly distributed among the urban centres with Nairobi having maintained over 40 per cent of the share although the share has been decreasing (Table 3.1. Appendix A). Ominde (1980) has **observed** that there has been a major spread of the Kenyan urbanisation process away from the dominance of the three major urban centres (Nairobi, Mombasa and Kisumu) between 1969 and 1979.²¹

The current Kenya Government Development Plan of 1979-83 has this to say:-

"The rapid rate of growth of urbanisation is essential to the realisation of the Plan, but it must be properly distributed throughout the nation. . . . It is, therefore, Government policy to spread urbanisation around the country rather than to permit excessive concentration in the major areas of Nairobi and Mombasa".^{oo}

3.1. Population and its growth rates in Nairobi

The evolving urban system in Kenya has been characterised by a high degree of polarisation. Nairobi as a primate city is a result of such polarisation. The primacy index is given by the formula:

$$pi = \frac{P_1}{P_2 + P_3 + \dots + P_n}$$

where PI is the primacy index; $P_1, P_2, P_3, \dots, P_n$ are the respective populations of 1st, 2nd, ..., n city in the country

This index measures the concentration of population in the first city in relation to the remaining cities. The greater the index value, the greater the concentration in the largest city. Taking the four major urban centres of Nairobi, Mombasa, Kisumu and Nakuru, primacy indices have been computed for the period 1948-2000 (Table 3.1.1).

Table 3.1.1 KENYA: RATES OF URBAN PRIMACY

YR	PI
1948	1.05
1962	1.03
1969	1.56
1979	1.21
2000	1.37

Sources: Ominde S.H., 1977, Spatial Population Change-Kenya Case Study/1979 Population Census.

This primacy of Nairobi has been matched by a high rate of its urban population increase over the years. Among others, differences in the nature of censuses, setbacks in the administration of headcounts and surveys have all gone in to yield varied figures for the urban population in Nairobi. Before the 1969 census, earlier population figures were mainly estimates that were fraught with many errors. Inevitably, we have to use these figures in projecting our future population data. From whichever source, however, it is true that though the absolute population numbers have been increasing, the growth rates have been on the decrease. Table 1.1.2(a) in Chapter 1 and Table 3.1.2 reveal that the growth rate of the urban population in Nairobi has been about 5.0. per cent and above.

Table 3.1.2. POPULATION OF NAIROBI AND GROWTH RATES 1948 - 1979

Year	Population (000)	Period	% annual Growth Rate
1948	119	1948-62	7.6
1962	344	1962-69	5.6
1969	509	1969-79	4.9
1979	828		

Source: 1969 and 1979 censuses, Central Bureau of Statistics, Ministry of Economic Planning and Development, Nairobi.

Using the available limited data, varied projection have been worked out though some seem erroneous frpm the basis of the 1979 census. Table 2.1.2 (Appendix A) suggests that the growth rate decreased from 6.9% per year between 1971-74 to 5.4% per year in 1985 while Table 3.1.3 shows that it decreased from 6.8% per year in 1971 to 5.1% per year in 1985.

Table 3.1.3 POPULATION OF NAIROBI AND GROWTH RATES.
1971 - 1985

Year	Population (000)	% annual growth rates
1971	585	6.8
1972	626	6.6
1973	669	6.6
1974	715	6.5
1975	763	6.5
1976	814	6.4
1977	868	6.6
1978	927	6.5
1979	989	5.8
1980	1048	5.9
1981	1112	5.9
1982	1179	5.9
1983	1251	5.8
1984	1326	5.1
1985	1396	

Source: Nairobi Urban Study Group; Nairobi-Metropolitan Growth Strategy, Volume 2, Table 1.13, 1973.

Ominde (1980) suggests that Nairobi could expect a total population from about 300,000 (1979) to about 1 million in 1984 and 1.2 million in 1989 and about 2.8 million by the year 2000." These growths represent 4.5% (1979-84), 3.7% (1984-89) and 7.7% (1989-2000). While the first two appear to conform with the general trend of decreasing growth rates, the last one appears odd. A growth rate of 7.7% for 1989-2000 would mean more than twice the increase in the number of migrants being currently experienced. With the prevailing urban trends, the probability of such an increase is low since there is a concerted effort to slow rural-urban migration and more so that urbanisation is spreading away from Nairobi.

Projections are subject to under or over-estimating the actual figures. Due to this, it may be more accurate to give a range of values within which the actual should fall. Nairobi Urban Study Group (1973) estimated that Nairobi will have a population of between 2.9 million and 4.2 million by the end of this century from a population of about 700,000 in 1973. This suggests that the growth rate would be between 5.3% and 6.6% per year. The same group also offers low and high projected

growth rates for the period 1969-2000 (Table 3.1.4).

Table 3.1.4. PROJECTED GROWTH RATES OF TOTAL POPULATION
1969 - 2000

Year/Period	Low, % p.a.	High, % p.a.
1969	7.30	7.30
1974	7.30	7.50
1979	6.70	7.40
1984	5.80	7.20
1989	4.60	6.75
1994	3.40	6.25
1999	3.30	6.25
1969-2000	5.75	7.00

Source: Nairobi Urban Study Group; Nairobi-Metropolitan
Growth Strategy, Volume 2, Table 1.7, 1973.

With the 1969 population figure, the above table suggests that Nairobi should have a population in the range of 3 million to 4.5 million by the year 2000. If instead the 1979 population figure was used, the expected figures would be between 2.8 million and 3.6 million. While the former case seems to have very high figures from the current growth rates, the latter appears to be within

a reasonable margin.

An alternative projection by Memon (1975) suggests that we can expect Nairobi to have a population of between 2,883,000 and 4,200,000 persons by the year 2000⁵. These would represent about 42% and 46% of the total urban population in the same year from the low and high projections respectively. From the population figures and percentages of total urban (Table 3.1.5(a). Appendix A), growth rates have been computed for the period 1948-2000 (Table 3.1.5(b)),

KENYA - URBAN GROWTH RATES (%)

	1948 - 62	1962 - 69	1969 - 2000	
			Low	High
Total	6.4	6.8	6.2	7.2
Nairobi	5.8	9.2	5.6	6.8

Source: Based on population figures in Table 3.1.5(a)

From the growth rates in Table 1.1.2(a), it may be suggested that if the downward trend of the growth rates continues, then the year 2000 will experience a growth rate within the range of 4.5% to 6.0% per year,

since the fluctuations since 1970 have not been quite diverse. This will mean having a population of between 2.1 million and 2.9 million by the end of the century if the 1979 population figure is employed. A review of all the growth rates suggested may now be made to gain deeper insights into the varied sources of urban population estimates for Nairobi (Table 3.1.6).

<u>Table 3.1.6</u> NAIROBI: SUMMARY OF GROWTH RATES		
Source	Period	Growth Rate (%)
Table 2.1	1971-2000	5.5
Table 3.1.3	1979-1985	5.7
Ominde (1980)	1979-2000	6.0
Nairobi Urban STudy Group(1973)	1973-2000	5.2-6.6
Table 3.1.4	1969-2000	5.75-7.00
Table 3.1.5(b)	1969-2000	5.6-6.8
Author	1979-2000	4.5-6.0
Table 3.2.1	1969-2000	6.30-7.60

Even if the lowest growth rate of 4.5% per year was to be realised, all these projections go in to confirm the hypothesis that Nairobi's current high rate of urbanisation

will still continue in the near future. Annual growth rates in excess of 3% per cent are considered high.

The basis of all urban growth of Nairobi has been secondary data. From the growth rates in Table 3.1.6, it is clear that various sources suggest different projected growth rates. These encompass the periods 1969-2000, 1971-2000, 1973-2000, 1979-1985, 1979-2000 with rates in the range 4.5-7.6. These differences in the projected rates arise because of the initial population used by each source in its base year. Yet another factor is the annual urban population growth rate over the time period in question - this further depends on the assumptions taken as concerns the levels of fertility and mortality over the same time periods. Since each assumption is bound to carry its own weaknesses, so does each of the projected growth rates. Hence if any of these rates is to be used, then some amount of limitation that each carries has to be borne in mind.

3.1.1 Population Distribution in Nairobi

As already mentioned in Chapter 1, the distribution of population in Nairobi is quite uneven with the majority of the people staying in the East. The wards that have large population sizes are also characterized by overcrowding. From the 1979 census, the outstanding ones in terms of population size include, Mathare (68,456), Kibera/Woodley (63,353), Eastleigh (53,562), Kariobangi (43,349). Densities are just as varied as the population sizes. Mbotela had the highest population density of 43,978 persons per square kilometre. This was followed by Pumwani (36,007), Maringo (32,707), Mathare (29,006) and Maisha/Makongeni (27,676). Both the wards with high population sizes and high densities are important to this study since they are sources of the demand for public transportation services. These areas dictate the direction and volume flow of the public transportation services from the number of public vehicles travelling to these areas.

3.1.2 Intra-Urban Population Changes in Nairobi

These refer to the change of residential areas by the urban dwellers either through self-will or forced movement. They also include changes whereby residents are acquired into the urban area due to the expansion of municipal boundaries.

Free will Movement

This results from the emergence of various types of places of residence to accommodate corresponding socio-economic groups of the urbanites. The movement could represent a vertical social mobility in which a group of people moves to a better quality area of residence than the previous one. A good case in point is Buru Buru Estate in Eastlands which has drawn middle-class residents from all over other estates of Nairobi.

A horizontal mobility is discernable in cases, where people move from one area to another of almost equal status. This could be out of social (influence from friends or ethnic groups) or economic (proximity to place of work) factors. This kind of movement is quite prevalent among slum areas like Kawangware, Kariobangi, Kibera, Riruta.

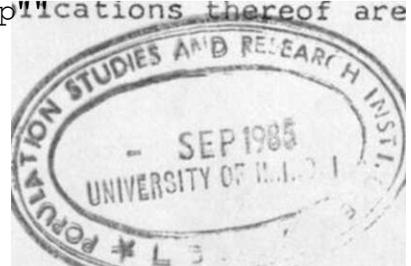
Forced Movement

Slums (especially Mathare) have always been victims to this kind of movement in which both direct (bulldozing the shanties) and indirect (by threats or burning the shanties) methods are applied to relocate the residents albeit their resistance. More often than not, groups of people get rehabilitated in other slum areas.

Boundary Expansions

Apart from the absolute increase in the number of urban residents, there has also been an increment in the area under the Municipal jurisdiction which has to be offered services among them urban transportation. There were boundary expansions in 1919, 1928, 1963 with the last one in the 1970s. These expansions have assumed a somewhat linear trend running from the East and North-East (Eastlands) to the South-West (Dagoretti) via the city centre.

This trend together with the above intra-urban population changes have given rise to the present spatial population distribution in Nairobi. Since this distribution very much determines the direction and volume of flow of traffic, the implications thereof are



discussed in Chapter VI with special reference to the region East of the City Centre (see section 6.1.3). This region is given special reference since, apart from containing almost 50 per cent of the total population of Nairobi (45 per cent in 1979 census), most of its population is vulnerable to the intra-urban population changes together with being in great demand for public urban transport.

3.2. Components of the Urban Growth in Nairobi

To be in a position to cope with the problems due to urbanisation, it appears logical to go back to the root source of the process. The contribution of immigration and natural increase in each one's accord should shed some light as to which of the two is the primary source. While data on natural increase is easily accessible (a product of the fertility and mortality of urbanites), data concerning immigration is hard to come by hence estimations are largely used. In an attempt to estimate the rate of immigration in Nairobi, the Nairobi Urban Study Group (1973) assumed that the net number of immigrants for a certain period (say 1962-69) is equal to the population of Nairobi at the end of the period (1969) less the survivors of the original (1962) population and less the survivors of the

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population born in Nairobi during the period. Unavailability of reliable data of immigration poses great
i difficulties of prediction. The 1969 census showed that there had been substantial immigration between 1962 and 1969. Ominde's (1980) assertion that only 17.7 per cent of Nairobi's African population between 1962 and 1969

could be accounted for by the existing population goes in

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to confirm the substantial increase of immigrants.

Even after 1969, immigration has continued at a high rate as 75.8% and 74.4% of the urban population in Nairobi were migrants from the 1969 and 1979 censuses respectively.

Of the total urban population of 509,286 in 1969 and 827,775 in 1979, we had 386,039 and 615,942 respectively as migrants. This represents an average annual increase of about 6.0%. For purposes of projections, the Nairobi Study Group (1973) selected two rates of immigration so that the actual could fall within them. The lower of the two assumed that immigration would decline at an increasing rate over the period, so that by 1999 it would have fallen to as little as 0.9% of the preceding year's population'.

This assumption would yield a population of 2,880,000 by the end of this century. The higher rate assumed a declining immigration rate, but at a steady rate of decline from the 1962-69 rate. With a minimum rate of 3.35% in 1999, there would be still higher absolute annual numbers of immigrants to the city at the end of the century than in 1973. This should yield a population

of 4,200,000 in 2000. The difference between the low and high forecasts of 1,320,000 can be attributed entirely to the numbers of immigrants under the two assumptions, and their differential natural increase. The projected rates are shown in Table 3.2.1.

Table 3.2.1. PROJECTED GROWTH RATES OF AFRICAN POPULATION: 1969-2000

	Low, % p. a.			High, 1 p. a.		
	NI	IM	Total	NI	IM	Total
1969	2.70	6.50	8.65	2.70	6.50	8.65
1974	3.05	5.70	8.20	3.05	5.95	8.40
1979	3.05	4.70	7.25	3.05	5.50	8.00
1984	3.00	3.50	6.15	2.95	5.15	7.60
1989	2.80	2.20	4.75	2.95	4.00	7.00
1994	2.55	1.00	3.45	2.75	4.00	6.35
1999	2.45	.90	3.35	2.80	3.55	6.00
2000						
1969-2000			6.30			7.60

NI - Natural Increase IM - Immigration

Source: Nairobi Urban Study Group; Nairobi-Metropolitan Growth Strategy, Volume 2, Table 1.6, 1973.

In terms of projected absolute numbers of increase, the same Study Group has both low and high projections with each showing increases due to natural growth, number of immigrants and total number of increase (Table 3.2.2 and 3.2.: AppendixA). The low projection (Table 3.2.2) suggests that increase by natural growth is expected to continue rising till the year 2000 while the number of immigrants will have a steady increase up to 1989 then start to decline. The other alternative of high projection (Table 3.2.3) shows a steady increase in both the number of immigrants and that due to natural growth up to the year 2000. A clearer comparison between the contribution of natural increase and immigration could be reached if percentages of total increase for each were calculated. From the two tables above, two corresponding tables are derived to show the percentages of total increase attributable to immigration and natural increase (Tables 3.2.4. & 3.2.5).

Table 3.2.4. LOW PROJECTION: NAIROBI AFRICAN POPULATION INCREASE.

Period	Natural Increase % age of total	Immigration % aae of total
1969-74	28	72
1974-79	34	66
1979-84	39	61
1984-89	46	54
1989-94	56	44
1994-99	72	28
1999-2000	73	27

Based on figures from ~~TABLE 3.2~~ 'T

Table 3.2.5: HIGH PROJECTION: NAIROBI AFRICAN
POPULATION INCREASE

Period	Natural Increase % age of total	Immigration % age of total
1969-74	28	72
1974-79	33	67
1979-84	35	65
1984-89	35	65
1989-94	39	61
1994-99	41	59
1999-2000	44	56

Source: Based on figures in Table 3.2.3.

Both the percentage of total increase and growth rate attributed to each of the two components of urban growth can be used to assess the relative importance of each. A summary of the various percentages and growth rates already cited is presented below (Table 3.2.6).

Table 3.2.6. NAIROBI: SUMMARY OF CONTRIBUTIONS TO URBAN GROWTH.

Source	IM	NI	Period
1969 Census	75.8%		1969
1979 Census	74.4%		1979
Table 2.1.2	3.0% (out of 5.4% overall)		1985
Table 2.1	49%	51%	2000
Table 3.2.1	3.50%	3.00%	1985(L)
ii	3.55%	2.80%	2000(H)
Table 3.2.4	54%	46%	1990(L)
Table 3.2.5	56%	44%	2000(H)

IM - Immigration

IN - Natural Increase

(L) - Low Projection

(H) - High Projection

From these percentages and growth rates (Table 3.2.6), it seems quite safe to expect that Nairobi's urban population will have 50% and above as migrants up till the year 1985. They also suggest that the contribution of immigration to the total urban increase is expected to remain significant

(at least at 40%) even up to the year 2000. This does not only ascertain the hypothesis that 'the high urbanisation rate of Nairobi has been largely the result of the rural-urban migration other than due to the natural increase of the urbanites', but it also gives a hint that rural-urban migration is still a formidable force to reckon with in the near future.

Because of the various problems associated with the urbanisation process and due to the fact that the process is enhanced more by the rural-urban migration, there is need to consider ways and means of controlling or curbing the process. To get the essence of urbanisation, it should be looked at as the combination of deep evolutionary changes in social values, motivations, technologies and economic systems rather than as a simple process of urban growth. Along this line, the process of urbanisation has not been sufficiently studied resulting to an inadequate basis for planning. While we inevitably have to accept that urbanisation is an inseparable part of the overall national development strategy, spatial planning to accommodate the rapid urban growths constitute some of the major challenges.

3.3. Government Policy on Urbanisation

It is accepted that growth will continue in both urban and rural settings to mutual advantage; hence urbanisation wherever it results from the expansion of economic opportunities is welcomed by the Government as a sign of and a contribution to the economic development of the nation. However, the excessive influx of migrants into Nairobi especially got the government so concerned that there developed a growing emphasis on restraining rural-urban migration and on getting the urban unemployed to go "back to the land". This was through the Vagrancy Act which was passed in 1968. This Act is supposed to enable urban centres to repatriate to the rural areas migrants who 'fail' to take advantage of productive and legal economic opportunities in the towns. Though concern about rural-urban drift has been translated into some government action (the Act), the action has been directed more at the symptoms than at the real causes of the problem. This in part, explains why the action has bitterly failed to yield any substantial results. Below follows the official Government stand about the high rate of urbanisation as portrayed in the 1979-83 Development Plan

"The emphasis on rural development in this Plan

will establish more reasonable balance between urban and rural development. By increasing development in the rural areas and by increasing incentives for industrial dispersion, the Government expects to enhance the attractiveness of living in rural and semi-urban areas. These activities will spread development more widely, ease the flow of migrants to the major urban areas and reduce pressures on municipal budgets", (para. 1.57)

"The rapid rate of growth of urbanisation is essential to the realisation of the Plan, but it must be properly distributed throughout the nation. It is therefore Government policy to spread urbanisation around the country rather than to permit excessive concentration in the major areas of Nairobi and Mombasa'", (para 2.105).

"The national objectives of balanced development and alleviation of poverty, require an urban development strategy that controls polarisation towards Nairobi and Mombasa, and that emphasizes the development of other centres with potential for supporting rural development", (para 2.106").

Using the 1979 Census data, Ominde (1980) found out that there has been a major spread of the Kenyan urbanisation process away from the dominance of the three major urban centres. He adds that the development of urban centres below 200,000 suggests that in the Kenyan urban system, national development policies in the last few years in favour of decentralised urban system have begun to yield fruits. As well, the Government is already strengthening the infrastructural facilities through the construction of industrial estates and encouragement of location of industrial activities.

It is often held that Government must intervene to slow down urbanisation here, spread it there, initiate it still elsewhere. But how are we certain that it will be more beneficial in location A than in location B? Laurenti and Gerhart (1977) feel that the only certain thing about such a policy is that it will hinder general economic progress, since the Government, and the decision-makers can never know where there is a net gain in transferring to, or starting up an urban setting.³¹

3.3.1. Problems in Planning and Implementation

The rapid urban growth coupled with the inadequacy of data in urban areas, how this change affects the social structure and economic functions go in to reduce the utility of most of the comprehensive town plans. There is an apparent gap between the planners and the policy-makers who make the decisions such that so much valuable time is wasted before communication gets through or worse still, it fails completely to get through. Ominde (1980) comments:

"Strong dependence on external Governments as sources of funds, the long time it takes to negotiate for such funds and the limited capacities to service the large funds normally needed are some of the Serious constraints in dealing with the urgent spatial planning problems in the country".³²

Alongside, Memon (1975) adds that if Kenya's national development strategy is to continue being dependent on an exogenous orientation, Nairobi and to a lesser extent Mombasa, will continue to be the prime location sites for urban-based economic activities and for the rural migrants from the country-side.³³

This is quite true since foreign investors come here with conditions that ensure them of maximum economic gain. Their economic cost/benefit analysis with no due regard to the social gain/loss is nearly always in favour of the already developed major urban centres. This dependence, though at times inevitable, appears quite a handicap to the national policy of decentralisation of urban areas.

CHAPTER IVTRENDS IN TRANSPORTATION SERVICES IN NAIROBI

Adequate transportation facilities are a necessity to the national development in any country, as well, it is catalytic and complementary to other sectors of the economy. Road transportation is the most important mode of transport in Kenya. Ironically, there exists neither a comprehensive national nor urban transport systems policy. Public urban transportation has been entirely left to the private sector with minimal Government involvement in the planning and provision of transportation services. Rather than evolving a system to provide adequate services, the private sector, guided by the profit motive, has dictated the pace of development rates. Because of the monopoly, public transportation services are inadequate in Nairobi. This places difficulties on residents in their every day commuting to and from their places of work. The objective of obtaining maximum profits by the private sector has evolved a fare - structure whereby an increasing number of low-income groups can hardly cope with.

Many workers rely on walking (even up to 20 kilometres) to work and back home - considerable production time is wasted in the walk. Many others ride the buses only at the month-end; yet others develop a knack to charm bus conductors so no fares are paid, save for that tip to the conductor. Even for those who can afford the cost of public transportation, they tend to complain more of inconveniences and time spent during the journey other than the fares.

The common view that the urban poor are always nearest to their places of work (Industrial Area and Central Business District) is turning out to be an anomaly in Nairobi. The low-income groups are continuously being pushed to the periphery of the city. The result is long distances between residential and places of work: this places heavy demands on the , transportation services which are expected to be met from the meagre wages of the workers.

Similar work hours in almost all industries and services creates congestion, both in vehicles and on the roads, during peak periods. This double congestion has a negative effect on the conditions of roads. The

loads carried and vehicle capacities are in excess of what roads are designed to withstand hence the rapid wear and tear of roads long before their projected economic life. The poor mechanical conditions of some of the vehicles go in to accentuate the perpetual accidents and traffic jams.

Transportation services are mainly concentrated in the low-income residential areas to the east of the city centre and in some pockets in Nairobi West where there are high demands for such services.

Provision of public transportation services has been the monopoly of the KBS in Nairobi since 1934. But from 1973, matatus have increasingly plunged themselves into the lucrative transportation field such that today, the two giants (KBS and matatus), though operating on two completely different lines, are indispensable for the majority of the residents. Much as the two may seem to be competing, they actually supplement each other in an attempt to satisfy the increased demand on public urban transportation services. However, the competition gesture is inherent in their conflicting objectives.

4.1 Proposals in the offing

Many people have suggested that Nairobi needs some form of commuter railways, with the line to Kibera being put into immediate use. The Kenya Railways has the feeling that a rail - based urban commuter service spreading into places like Kangemi and Hamza would possess dynamics peculiar to a mass transit system.

There has been an assurance in parliament that feasibility studies for an uderground commuter system were underway; yet Kenya Railways engineers are sceptical as they say that soil characteristics were unsuitable for the "tubes" in Nairobi.' Belgium has shown a keen interest in assisting with a flyover road network-

Although a road-based flyover may introduce 'a relaxation to the peak-period choking of roads, galloping fuel prices worldwide would continue to be injurious to the country's economy. A light rail network is likely to be advantageous since it produces maximal economies in fuel usage. Since it has to be beneficial to the people it serves and viably commercial, the light rail

network must operate within densely populated areas. This will be definitely a serious threat to both the KBS and matatus. Discontent at a higher level is likely to result as this will be increasing foreign domination in the economy.

4.2. KBS Operations

KBS started operating in 1934 with a fleet of 35 13 buses on twelve routes. By end of 1979, there were 317 buses in operation using 95 routes. In 1966, the United Transport Overseas Limited of London, the parent foreign owned holding company, sold 25 per cent of the company's shares to the Nairobi City Council. Since its inception, the company has operated the public bus transport service in Nairobi under various franchise. The current one expires by the end of 1985.

KBS operations are regulated under the Public Service Vehicle (PSV) licensing provisions of the Traffic Act and the Transport Licensing Act of Kenya (1962). One of the primary requirements of Transport Licensing Act (1962) is that operators should publish

and have approved a route schedule and a fare structure.

Although the initial aim was/to serve within the city boundaries, KBS operations have now moved beyond these boundaries; however the role of the buses decreases with distance from the city centre. The furthest route being about 27 kilometres from the city centre, the Traffic Manager of KBS attributed the operation beyond the city boundaries to three reasons. Firstly, inadequate public transportation services resulted into increased demand from the residents of the adjoining areas who frequently come to the city. Secondly, lack of housing within the city has caused many people to stay in the suburban areas. These people need a regular and an efficient mode of public transportation since almost all are employed within the city. Lastly, it is more economical to operate on such routes as they avoid the congestion within the city centre. On 24th February 1982, the Transport and Licensing Board (TLB) approved KBS applications to operate routes from Nairobi to areas beyond the city boundaries. This was however not received lightly by matatu operators. The stiff opposition arose from the fact that KBS had

a monopoly agreement with the City Council to operate within city boundaries hence operating beyond these boundaries would be an intrusion into matatus areas.^{3G}

The Traffic Manager of KBS maintains that his company is providing adequate services to the general public but is contented that matatus are competitive at off-peak and complementary during peak periods (personal communication). Of the 282 buses that are dispatched at 6 a.m everyday, 82% continue throughout the day, while the rest are withdrawn after 8-30 a.m. Among the problems encountered by the company are shortage of manpower, peak period and matatu congestion, escalating costs of maintenance. Manpower training, local manufacture of spare parts, matatu control and subsidy of the imported hardware were likely to ease the company's problems (personal communication with T.M.). The bus fares ranging between Kshs 1.50 and Kshs 4.50, it has been argued, are deemed fair since the increases are always between 15% and 20% (ibid). The Traffic Manager concluded by being optimistic about the future of KBS as there seems very slim chances that the company will be

refused to renew its franchise after 1985 though there is a feeling that more and more people will continue being unable to afford riding in the buses if inflation continues with salaries lagging behind.

With 317 buses in operation in 1979, a total of about 99 million people a year and 270,000 people
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per day were recorded as passengers. Fleet and passenger numbers over the years are outlined below.

(Table 4.2.1).

Table 4.2.1 KBS OPERATING STAT.ISXICIT

YR	Buses Operational at year-end ^a	Annual Passengers (million) ^a	Bus per 1000 daily pass.
1962	100	24.0	1.5
1964	106	25.0	1.5
1968	146	42.0	1.3
1970	166	55.2	1.1
1971	195	76.2	0.9
1972	239	85.2	1.0
1973	264	87.6	1.1
1974	284	86.4	1.2
1975	290	84.0	1.3
1976	288	83.6	1.3
1977	285	83.6	1.2
1978	291	91.2	1.2
1979	317	98.4	1.2

Sources: a Records from KBS Ltd Company
Records from NCC (Transportation Unit).
Urban Transport Project, World Bank 1980.

In the table above, there is a consistent increase in both the fleet size and number of passengers until 1973 when the number of passengers started dwindling. This could be attributed to the influx of matatus into the city after the 1973 Presidential Decree (explained in section 4.3). However, the upward trend for KBS started again from 1978 after surviving the shock from matatus.

The increase/decrease of both the buses and passengers carried over the years constitutes a time series. A trend line or curve can be fitted to approximate the trend of the time series. In this case, a combined trend of the buses and passengers is considered since the supply of buses is directly dependent on the available number of passengers. Taking the fleet size (Y) as the dependent variable and the number of passengers (X) as the independent -variable, the method of least squares is used to fit the trend curve. The resulting regression equation is

$$Y = 24.204 + 2.88X$$

As concerns the ratio of the buses per 1000 daily passengers, there was a decrease from 1.5 in the 1960s to its lowest 0.9 in 1971. This picked up

to the current 1.2. A line graph (Figure 4.2.1) shows these changes. The sharp drop in the ratio between 1964 and 1971 can be explained from the Comparison of growth rates in the number of buses and passengers (see section 5.5). While the number of passengers increased from 13% in 1964 to 32.2% in 1971, the increase in the number of buses was 9.4% in 1964 and 17.5% in 1971 hence the drop in the ratio of buses per 1000 passengers since the passengers were increasing at a higher rate than that of the buses. The reverse rates of growth occurred between 1971 and 1975 resulting into a rise in the ratio.

In an attempt to find the relationship between the population numbers of various wards and the number of buses that serve these wards, four, three and two wards were randomly chosen from the high, medium and low density residential areas respectively. The approximate population numbers for 1982 of these wards together with the number of buses serving these wards as of May 1982 are tabulated below (Table 4.2.2).

Fig. 4.2.1 KBS : BUS PER 1,000 DAILY PASSENGERS.

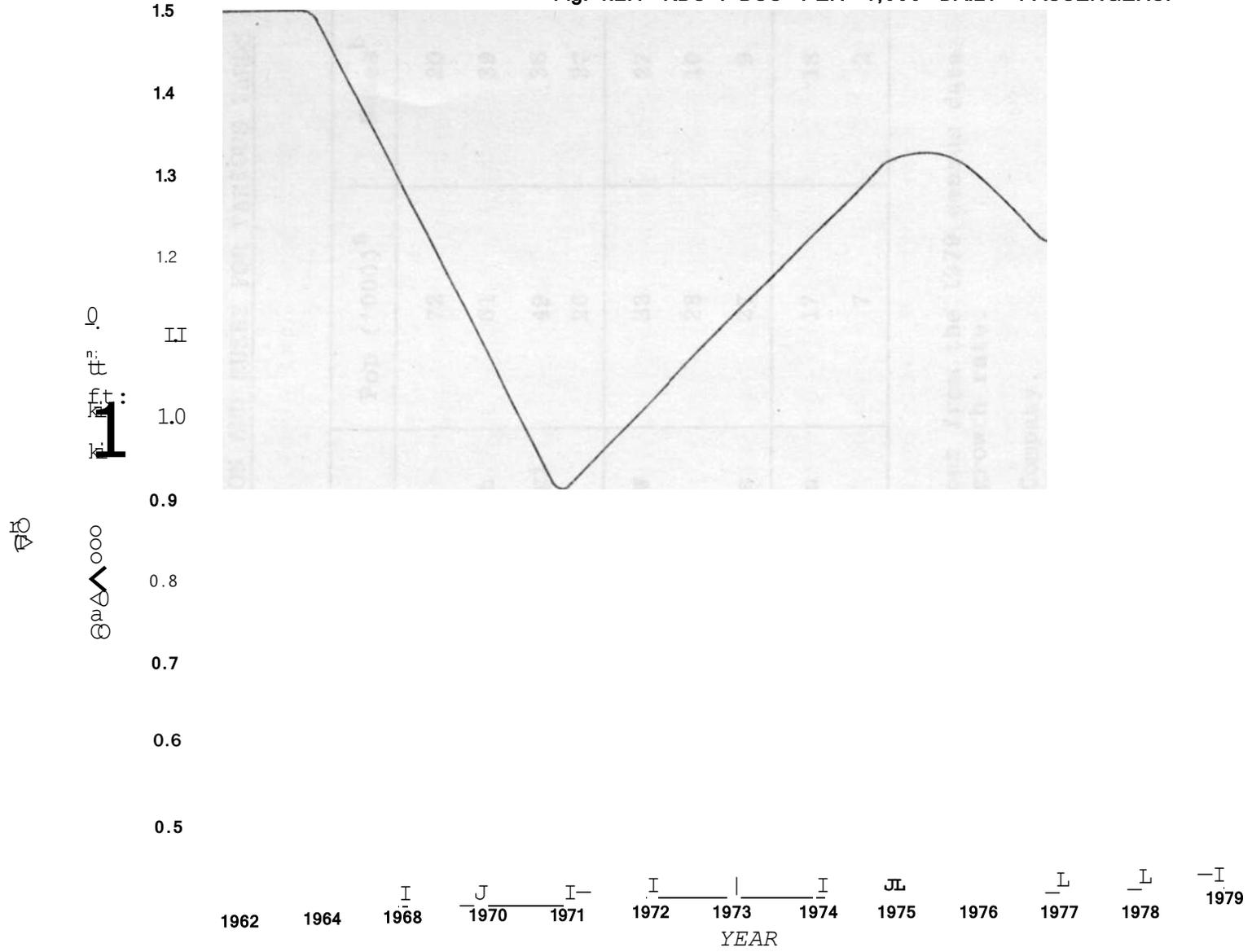


Table 4.2.2. POPULATION AND BUSES FOR VARIOUS WARDS

Density	Ward	Pop ('000) ^a	Buses* ³
High	Kibera	72	20
	Eastleigh	61	39
	Kariobangi	49	36
	Dandora	26	27
Medium	Nbi S ft W	33	27
	Umoja	28	10
	Parklands	27	9
Low	Lavington	17	18
	Karen	7	2

Sources: a Projections from the 1979 census data at 5.0% growth rate.

b KBS Ltd Company.

The relationship is not as systematic as would have been expected. This is suggestive of other intervening variables that go in to mar the direct influence of the population size on the number of buses. Among the plausible variables include the proportion of the total population size of a ward that uses the buses hence the profitability aspect on the various routes;

the number of different wards the buses serve enroute to the destined ward. Due to this intervention, the two have a coefficient of correlation of 0.54 (significant at 90% confidence level) such that ² population size explains only 29% ($r = 0.2916$) of the variation in the number of buses.

To substantially offset the financial constraints, the KBS company has had to increase the bus fare at least once each year since 1974 with 16% increase in 1977 as the lowest and 40% as the highest in 1981 ³⁸ (KBS Planning and Research Office). The current fare structure is based on fare zones characterised by concentric circles around the city centre. The average distance in kilometres from the city and the corresponding fares are shown below (Table 4.2.3).

Table 4.2.3. DISTANCE VS COST

Distance (km) ^a	Cost (Kshs) ^a	Cost/km	Cost/km (excl. fixed cost)
5	1.50	0.30	0.10
8	2.00	0.25	0.13
12	2.50	0.21	0.13
15	3.00	0.20	0.13
20	3.50	0.18	0.13
25	4.00	0.16	0.12

Source: a KBS Research and Planning Office.

The fare of a journey consists of a fare function of the form

$$Y = a + bX, \text{ where } Y = \text{fare value}$$

$X =$ distance in kilometres

$b =$ rate of change of fare value with respect to distance.

$a =$ fixed element in fare structure.

Applying the regression model to the above data in order to estimate the fare function, we obtain the function below:

$$Y = 100 + 12X, \quad Y \text{ units in cents}$$

X units in kilometres.

This fare function says that for every fare-value, 100 cents is fixed, irrespective of the distance travelled and 12 cents per every kilometre travelled is the variable component. When this fare function of 1982 is compared to the one of 1979 which was

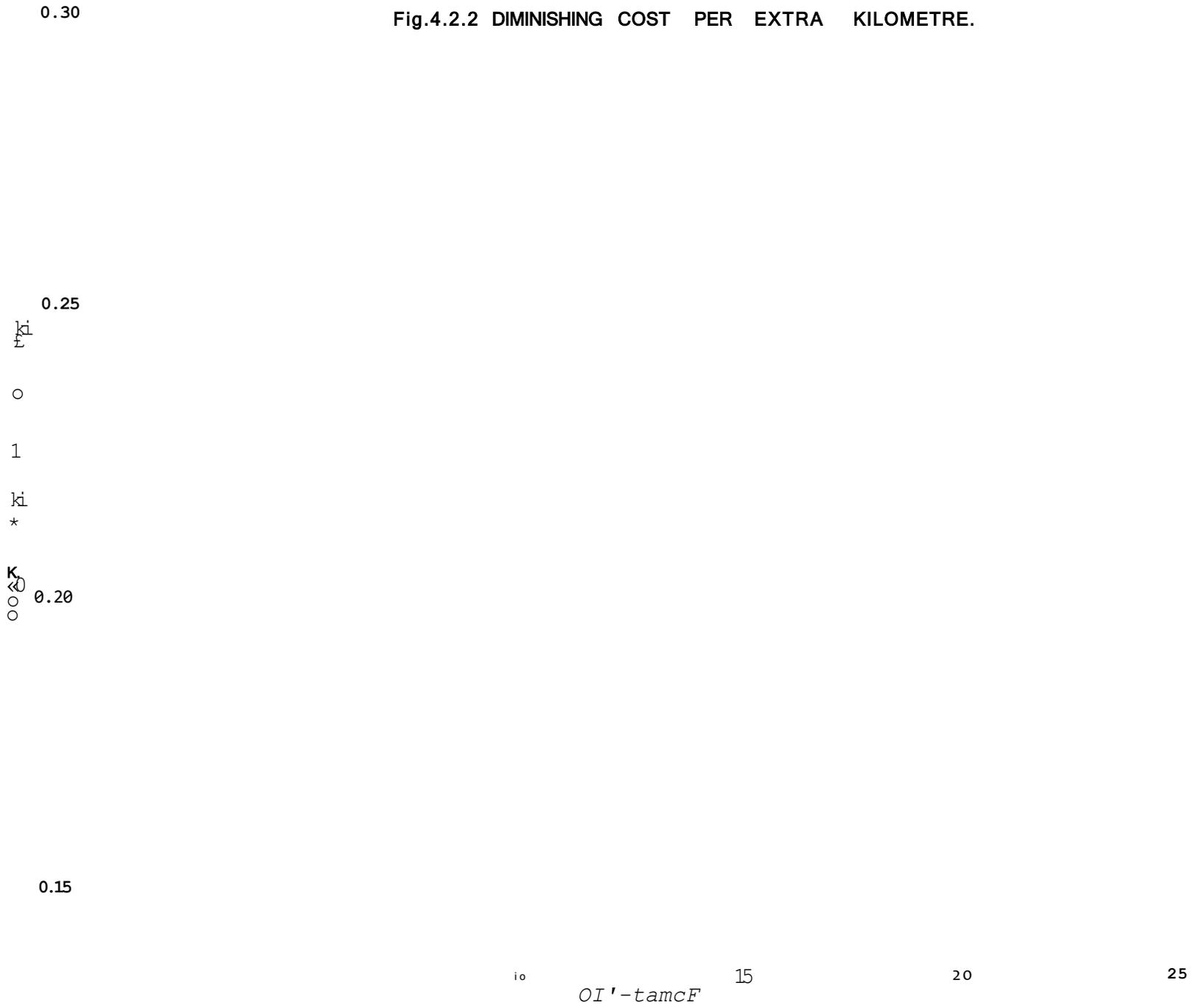
39

$Y = 60 + 6.7X$ (Research and Planning Office), then it is apparent that the fixed component has been increased by 67% and the variable component by 79%.

Although aggregate cost increases with distance, the cost per additional kilometre decreases with distance. Figure 4.2.2. illustrates this from the above data.

While the fare function used by KBS convinces us that the relative cost per kilometre tapers off with distance, a close scrutiny of the variable component reveals a contradiction. Since the fixed component is constant for all passengers, the variable component becomes very crucial in the distance versus cost relationship. As can be seen from table 4.2.3., the cost per kilometre (excluding the fixed component) is 10 cents for up to 5 kilometres, then rises to 13 cents and remains constant for any distance farther than 5 kilometres. This implies that people staying far away from the city centre pay more for an extra kilometre than the people nearby the city centre - this is the reverse for the case of the whole fare function.

Fig.4.2.2 DIMINISHING COST PER EXTRA KILOMETRE.



4.3. Matatu Operations

Originally known as 'pirate taxis', matatus became prevalent in the 1960s as a spontaneous response to demand for public transport. Though started illegally, the 1973 Decree enabled them to become legal public carriers. The June 1973 Presidential Decree exempted matatu operators from section 4(b) of the Transport Licensing Act (Cap. 404) but they were not exempted from the provisions of the Traffic Act (Cap. 403). The exemption of matatus from holding a PSV licence has been misconceived by the operators that they were free to contravene all other transport and traffic regulations. As of January 1st 1980, all matatus are required by law to display insurance certificates to indicate the number of passengers insured. The effectiveness of this enforcement cannot be determined since the re-organization of matatus is at its grass-roots and is hardly cohesive. If

implemented effectively, this will have adverse effects because the overloading factor contributes to profit.

Due to the misconception of the Decree, accidents by matatus due to overspeeding, overtaking on the wrong side, ignoring traffic lights, jumping intersections and even refusing to stop when ordered by police are prevalent and on the increase. Police maintain that their authority over matatus is limited because of the matatu exemption from the Act. As long as matatus are treated in law as private vehicles, the police cannot enforce necessary safety measures, such as annual mechanical inspection, restrictions on passenger loading and mandatory carrying of safety equipment.

According to the Kenya 1979/83 Development Plan, matatus will be required to comply with the requirements of the Traffic Act as it relates to speeding,
AQ
overloading, roadworthiness and insurance." It has been stressed that Nairobi City Council issues special Nairobi PSV licences particularly for matatus that have passed roadworthiness inspection and are properly

insured; police check regularly and prosecute the drivers of vehicles carrying more than the insured number of passengers and that licences of drivers be revoked for repeated violations; insurance companies be warned not to insure a vehicle for more passengers than its related capacity based on its construction; and finally, the matatu drivers be required to hold the Institute of Advanced Motoring Licence. It is further recommended that section 17 of the Traffic Act be amended to provide for mandatory inspection every six months or twice a year.

These limitations should not mar the advantages due to existence of matatus. The supplementary services to KBS, flexibility in routes and stop-points are on the whole appreciated. Another advantage is the employment the matatus have created for thousands of people: Coopers & Lybrand (1980) suggests that the -direct and indirect employment generated by matatus

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might amount to 16,000 - 22,000 jobs. The Chairman of Matatu Owners Association (MOA) asserts that there were 15,000 permanent employees in Nairobi alone by end of 1981.

Before the Presidential Decree, there were only about 400 matatus. A 1976 NCC Survey stated that there were approximately 1400 urban matatus carrying » about 63,500 passengers per day.⁴² The KBS estimated that there were about 1550 urban matatus carrying
43
66,500 passengers per day in 1979. The most recent May 1980 approximation made by World Bank consultant Ian Barwell, (1980) suggests that up to 3,000 vehicles in Nairobi serve as matatus during some part of the day although only about 800 - 1000 of these are likely
44
to be full-time. The daily ridership is estimated at approximately 160,000 - 170,000 persons.

Although according to MOA there are 3,017 matatus in Nairobi alone, a survey for this study approximated the number to be about 1,700 with a daily ridership in the region of 250,000. The approximate increase in the number of matatus together with the corresponding number of passengers carried is given in Table 4.3.1.

Table 4.3.1. "ATATU FLEET SIZE AND PASSENGERS
CARRIED (1971 - R1)

Year	Fleet Size ³ "	Annual Passengers (m) ^a	Fleet per 1000 daily pass.
1971	217	14	5 7
1973	375	17	8 0
1974	538	23	8 5
1975	700	27	9 4
1976	969	37	9 6
1977	1320	51	9 4
1978	1434	60	8 7
1979	1567	71	8 0
1981	1700*	96*	6 5

Sources: a KBS Research and Planning Office.

* Survey of this study.

An upward trend in the increase of both matatus and their passengers has been maintained although the relative percentage increase declined between 1976 and 1978 and also between 1979 and 1981 for both (see section 5.5). The largest drop in the percentage

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increase was 27.6% in the matatus and 21.8% for the passengers between 1977 and 1978 (ibid). This coincides with the time the KBS was recovering from the recession it had suffered between 1973 and 1977.

The ratio of matatus per 1000 daily passengers was on the rise until 1976 when it was 9.6 and then has been dropping (Figure 4.3.1). This is in line with the growth rates (section 5.5). While the passengers were lagging behind the percentage increase in the matatus, the two almost levelled between 1976 and 1977 with the matatus increasing at 36.2% and passengers at 32.1%. Since 1977, the increase in passengers has been higher relative to that of matatus with the former at 15.1% and the latter at 4.2% by 1981.

Of the 265 matatus operators who gave meaningful responses from the survey, the findings on their views about some aspects of the matatu operations are tabulated below (Table 4.3.2).

Fig. 4.3.1 MATATU : FLEET PER 1,000 DAILY PASSENGERS

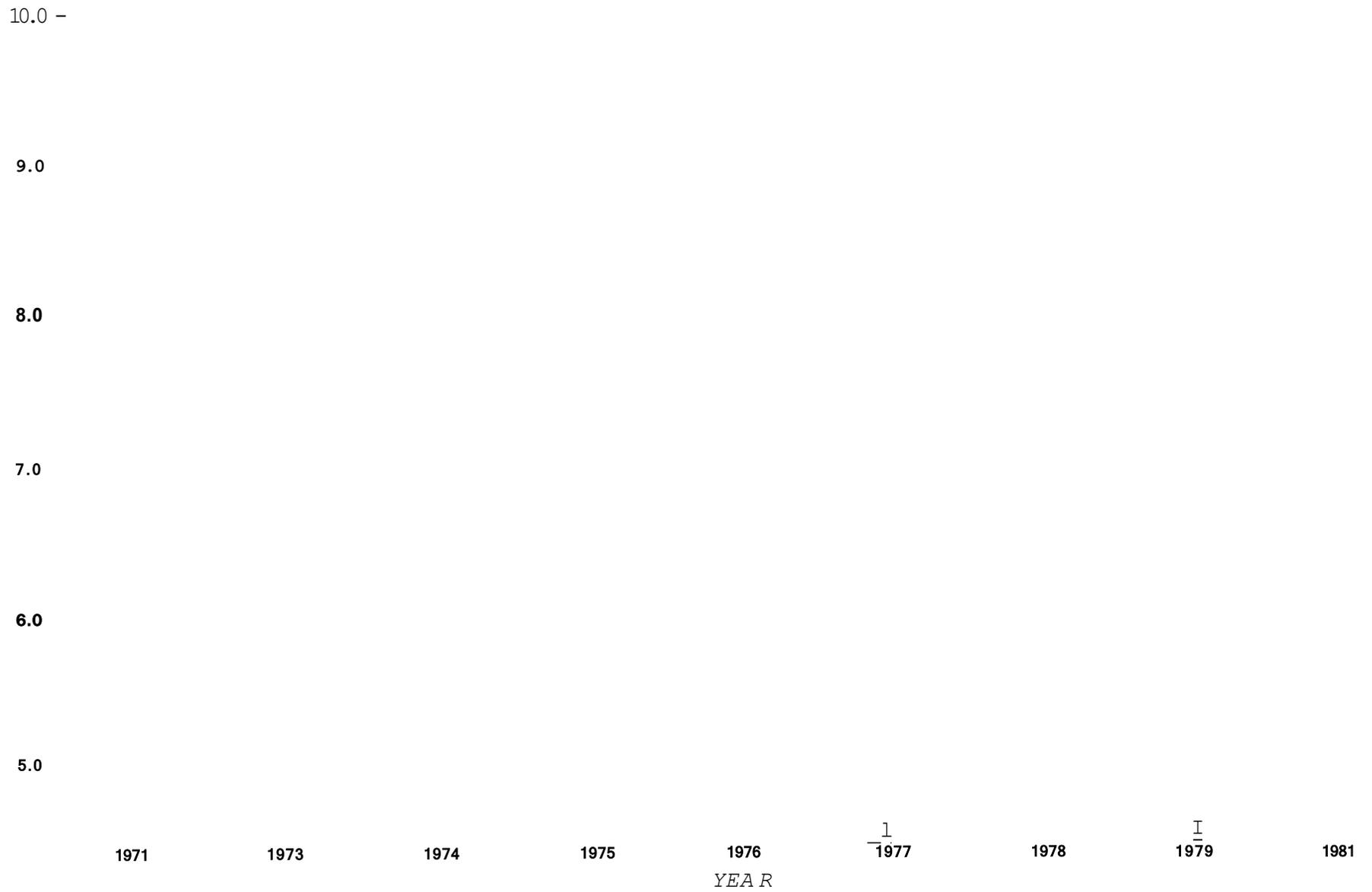


Table 4.3.2 SOME VIEWS OF MATATU OPERATORS

Subject	Yes	% of total
Matatus are a threat to KBS and vice versa.	260	98
'Compulsory' bribes to police	205	77
Matatus overload, overspeed and overtake/obstruet other road users	195	74
Unfair trials in courts	170	64
Adopt a standard matatu	64	24

Some of the reasons the operators gave as to why some people prefer using matatus included: extra facilities, for example radio that matatus offer; stop to drop or pick passengers according to one's convenience; cheaper than KBS and that matatus are faster than KBS. Apart from the two problems mentioned in the above table, others that are encountered by the matatu operators are, unnecessary police harrassment, molesting from passengers and high policy premiums. It was suggested by the operators that matatus should be widely accepted and respected, both by the public and police,

just like any other commercial enterprises; they be given fair trials in courts and premiums should be lowered. They felt that demand will continue to outweigh supply in future unless the Government introduces some form of mass transit and also institute a government - controlled competitor to the KBS. Though objected by officials of MOA, those operators in favour (24%, Table 4.3.2) of the Government's proposed standard matatu hoped that this would reduce overloading (since the number of passengers will be standard for all) and there would be no rushing for passengers hence no overspeeding.

The erratic and random behaviour of matatus has caused a lot of concern hence the campaigns by various institutions to curb the behaviour. The Government is currently reviewing the legal requirements pertaining to matatus and is also operating a matatu proto-type using diesel. The World Bank (1981) asks for matatu bays to be set up in order to streamline the matatu transport system; the Nairobi City Council to license them after
45
Government inspection." The Matatu Owners Association (MOA) aims at minimizing road accidents and helping in minimizing fuel consumption through various

regulations for the operators. It is hoped that all matatu operators will be forced to register with the, MOA and be obedient to the regulations.

4.4. KBS and Matatu Operations

A sample survey by the KBS Research and Planning Office (1979) gave the following statistics.⁴⁷

Mean Maximum peak matatu load = 20 passengers
per matatu/trip.

Standard deviation = 5 passengers

Mean Maximum peak KBS bus load = 150 passengers per
bus/trip.

Standard deviation = 20 passengers.

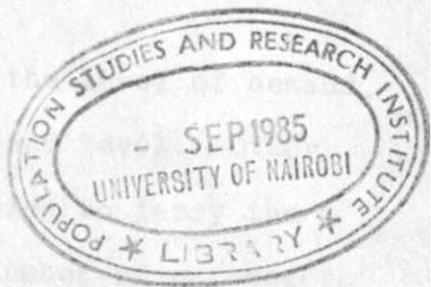
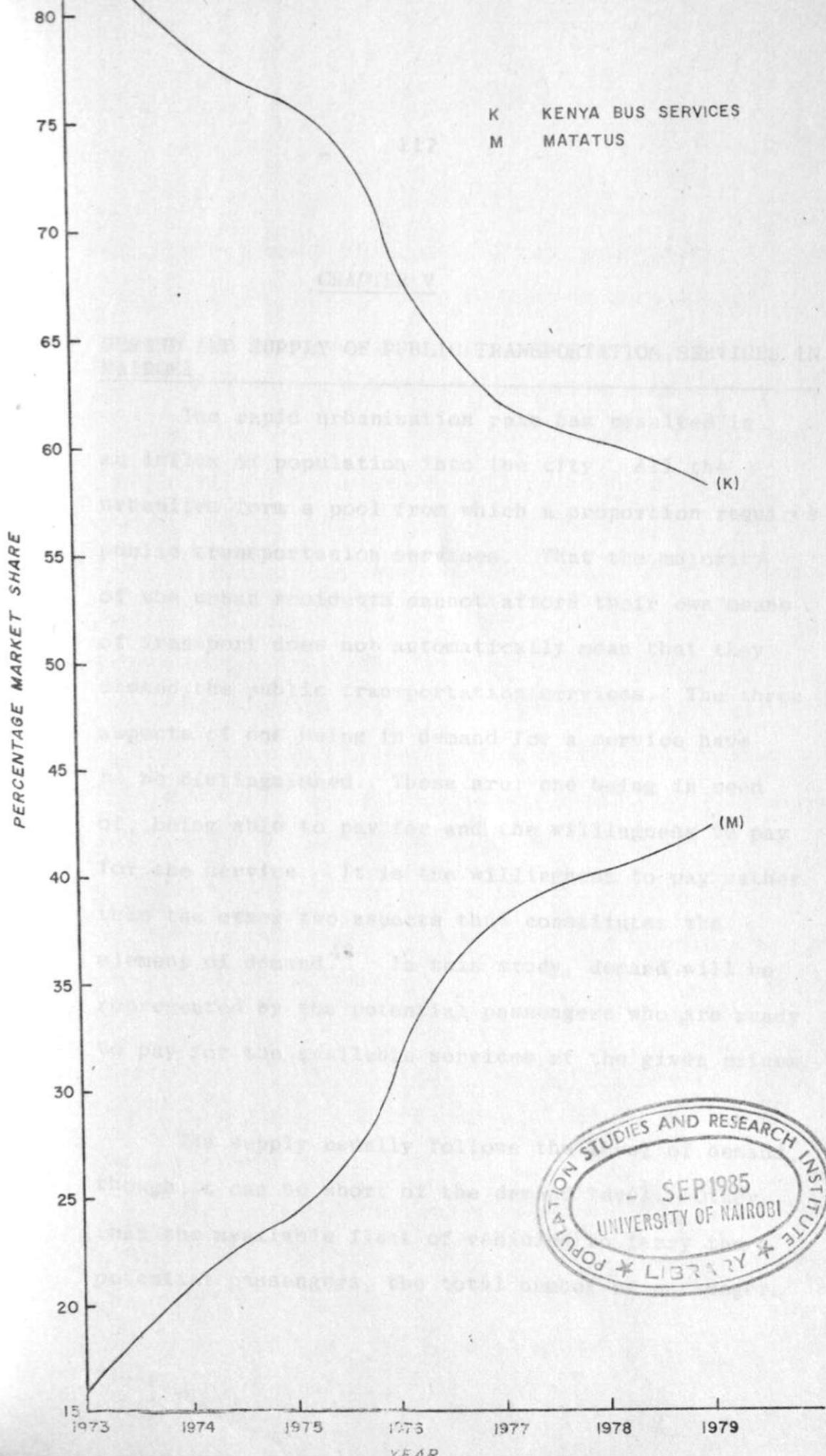
One bus is equivalent to 7.5 matatus in terms of carrying capacity. This maximum cannot be maintained throughout the day, but the rate of decline is expected to be uniform for both operators, in which case, the ratio still stands. The passengers ferried by both matatus and KBS are shown in (Table 4.4.1) below:

sloping curve (Figure 4.4.1). Statistical analysis of the data is contained in Chapter V.

Notes:

- a Daily Nation, Wednesday, January 6, 1982 page 11. While the then Assistant Minister for Transport and Communication (Hon. Gumo) assured the nation as to the feasibility of the commuter system, the engineers had the complete opposite view hence leaving everybody in a dilemma.
- b *ibid.*
A short while after the assurance on *tubes*, the Minister himself (Hon. Rubia) was in pursuit of a flyover road network when he talked to a Belgian commercial delegation. Thus hushed Belgium's earlier enthusiasm for a light rail network in the city. The two unrelented opinions emanating from the same Ministry only add confusion as per the remedial action to be taken by the Government.
- c Daily Nation, Wednesday, February 24, 1982
KBS buses were allowed to operate to places like Ruiru, Ndenderu, Limuru, Banana Hill, Gitaru, Kiambaa, Ndumberi, Githunguri, Ngong¹, Ongata Rongai and Athi River. Earlier, KBS was operating services to Kikuyu and Kiambu town on short-term licences.

Fig. 4.4.1 MARKET SHARE FOR KBS AND MATATUS.
(1973-1979)



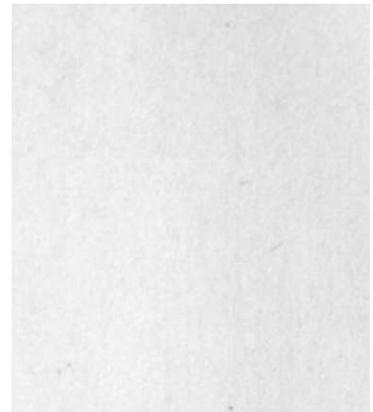
CHAPTER VDEMAND AND SUPPLY OF PUBLIC TRANSPORTATION SERVICES IN NAIROBI.

The rapid urbanisation rate has resulted in an influx of population into the city. All the urbanites form a pool from which a proportion requires public transportation services. That the majority of the urban residents cannot afford their own means of transport does not automatically mean that they demand the public transportation services. The three aspects of one being in demand for a service have to be distinguished. These are: one being in need of, being able to pay for and the willingness to pay for the service. It is the willingness to pay rather than the other two aspects that constitutes the

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element of demand. In this study, demand will be represented by the potential passengers who are ready to pay for the available services at the given prices.
t

The supply usually follows the level of demand, though it can be short of the demand level. Other than the available fleet of vehicles to ferry the potential passengers, the total number of passengers



carried by these vehicles will represent supply of the services. It would be logical to assume that demand for transportation has been commensurate with the increase in urban population. The emergence of the matatus and their sustained increase could be a testimony to the increase in the demand level.

This chapter takes up the evaluation of the demand and supply of the services for the post-independence era. The level of demand, the fleet increase for both KBS and matatus and the increase in the number of passengers carried by the two over the years will be analysed. Regression and correlation model will be used to analyse the relationships and effects between/among the variables. A look at the future prospects for the provision of the services will also be included.

5.1. Variables and their Characteristics

The data used for analysis is composed of five variables as follows:

X^{\wedge} = total population of Nairobi.

X_2 = number of KBS buses

X_g = matatu fleet size.

X = passengers carried by KBS.

X_5 = passengers carried by matatus

The actual figures for each variable, though with various gaps due to unavailability of data, are presented (Table 5.1.1). Due to lack of data for each variable at different time periods, the means, standard deviations and the subsequent analysis are based on the eight observations where every variable has some entry.

While each variable has been on the increase over the years, the number of KBS buses declined from 290 to 285 (1.7 percent) between 1975 and 1977. This could possibly be the result of the stiff competition from the matatus coupled with the high rate of inflation at the time. The accompanying decline in the passengers carried by KBS was even worse as 86.4 million passengers carried in 1974 decreased to 83.6 million (3.2 per cent) by 1977. This suggests that demand (passengers) can be very - sensitive to the level of supply (buses), more so if there is some other alternative of supply (matatus).

Population, matatu fleet size and the corresponding passengers carried by matatus have all maintained an increasingly upward trend. Growth rates for each variable are presented in section 5.5.

TABLE 5.1.1

NAIROBI: POPULATION, KBS AND MATATU FLEET SIZE AND PASSENGERS CARRIED.

YEAR	Population ²¹ (000)	KBS ^b		Matatus ⁰	
		Fleet	Annual Pass. (m)	Fleet	Annual Pass. (m)
1962	344	100	24.0	-	-
1964	-	106	25.0	-	-
1968	-	146	42.0	-	-
1969	509	-	-	-	-
1970	534	166	55.2	-	-
1971	566	195	76.2	217	14
1972	597	239	85.2	-	-
1973	629	264	87.6	375	17
1974	663	284	86.4	538	23
1975	700	290	84.0	700	27
1976	736	288	83.6	969	37
1977	776	285	83.6	1320	51
1978	818	291	91.2	1434	60
1979	828	317	98.4	1567	71
1980	913	-	-	-	-
1981	960	-	-	1700*	96*
Mean	715	277	87	890	38
Standard Deviation	92	36	6	510	21

Data not available

- Sources:
- a Central Bureau of Statistics, Ministry of Economic Planning and Development, Nairobi.
 - b Kenya Bus Services Limited Company, Nairobi.
 - c Nairobi City Council and Research/Planning Unit at the KBS, Nairobi.

Author's survey.

As of 1971, the KBS fleet was 90 per cent of the matatu fleet and had decreased to 20 per cent by 1979. More important is the increase in the number of passengers carried by matatus from 18 per cent of those carried by KBS in 1971 to 72 per cent in 1979. The exceptional high rate in the growth of matatus has meant a sizeable loss of the market share for the KBS. In order to avoid the frightening potential abyss, KBS has embarked on a programme of: scheduling/re-routing various routes, undertaking research into the nature of matatu operations and attracting more potential customers by reductions in the fare on specific routes.

5.2. Level of Demand

The Nairobi Urban Study Group (1973) found out that about 25 per cent of the total population (1972) was in demand for public urban transportation
49.

services.. Of the 325 households that were interviewed for this study, 236 had neither a car, motor-bike nor a bicycle. While this represents 73 per cent of the total who would require the services, only 56 per cent of the total usually use either KBS or matatus. From the question of how much one-way

trip costs, 58 per cent use either of the two (taking Sh. 1 and Shs 4.50 as the lowest and highest fares charged respectively by KBS and matatus).

We have to appreciate the fact that a passenger does not always stick to either KBS or matatus only. Many times the usage of the two is mixed up depending on where one is going to, convenience, time factor and others. Of the 25 and 157 interviewers who, from the survey, usually use matatus and KBS respectively, a question as to how many times in a week they use KBS (for the former) or matatus (for the latter group) provided some data that can be employed to estimate the combined usage of both KBS and matatus (Table 5.2.1).

From the percentages presented above, it is apparent that most passengers tend to use KBS on 4 days while they use matatus on 3 days in a week.

- This implies that

$$\frac{3M}{7} + \frac{4K}{7} = 1, \quad M = \text{matatus and } K = \text{KBS}$$

$$\text{and } 0.4M + 0.6K = 1 \dots \dots \dots (i)$$

TABLE 5.2.1: FREQUENCY OF KBS/MATATU USAGE BY PASSENGERS

No. of times KBS is used in a week	Freq.	% of total	No. of times a matatu is used in a week.	Freq.	% of
1	1	4	1	0	0
2	5	20	2	2	1.3
3	13	52	3	30	19.1
4	4	16	4	90	57.3
5	2	8	5	18	11.5
6	0	0	6	11	7.0
7	0	0	7	6	3.8
	25	100		• 57	100.0

Therefore, the total number of passengers (TP) for any time period can be arrived at by using the number of passengers carried by both matatus and KBS for the same period of time, as

$$TP = 0.4M + 0.6K \dots \dots \dots (ii)$$

It should be noted that M and K in the above formula represent the passengers and not the fleet of matatus and KBS respectively.



v y w m \

Applying formula (ii) to the survey data, we get

$$\begin{aligned} TP &= 0.4 (25) + 0.6 (157) \\ &= 104.2 \end{aligned}$$

This gives 32 per cent as the proportion of the total population that was in demand for public transportation services in 1981.

5.3. Relationship between Demand and Supply

In an attempt to obtain the number of passengers carried by both KBS and matatus, the above formula is used to estimate the total number of passengers (Table 5.3.1).

Since data on how many matatus operated during 1962 lacking and given that the number of passengers they ferried was relatively insignificant due to their illegal operation then, the passengers carried by KBS for 1962 (66,000) is assumed to represent the total number of passengers for that year. Operation of matatus was formalised at independence to give their operators a chance to enjoy the fruits of independence, much as other employed and self-employed persons.

TABLE 5.3.1.: TOTAL NUMBER OF PASSENGERS CARRIED ('000)

Yr	Daily Passengers		
	Pass. (KBS) ^a	Pass. (MAT) ^b	T _{PC} ^c
1962	66	na	(66)
1970	151	na	na
1971	209	38	141
1972	233	na	146
1973	240	47	163
1974	237	63	167
1975	230	74	168
1976	229	101	178
1977	229	140	193
1978	250	164	216
1979	270	195	240
1981	.	263	291

Note : na - Data not available

Sources:

- a Kenya Bus Services Limited Company, Nairobi
- b Nairobi City Council and Research/Planning Unit of Kenya Bus Services Limited Company, Nairobi.
- c Calculated from a and b

In 1962, the proportion of the population that was in demand for public transportation services is estimated to have been about 20 per cent. While this proportion rose to 25 per cent by 1972, it is estimated to have reached 30 per cent by 1979 and 32 per cent in 1981. These proportions yield the number of potential passengers who were in demand for the services. These, when compared to the total passengers actually carried, provide a basis in the evaluation as to whether or not supply is meeting demand.

Accounting for 60 per cent of all the passengers carried, a separate treatment for the KBS performance may be warranted. Apart from the decreasing trend in its market share, there has been a decline in demand for KBS. Passengers per day declined from 240,000 in 1973 to 229,000 in 1977.⁵⁰ Using the 0.6 share of the total passengers, we can obtain the passengers who were in demand for KBS services only as

$$\text{Pass, in demand (K)} = \frac{\text{per cent proportion in demand (total)}}{\text{population}} \times 0.6 \times$$

Those who were actually carried by the KBS is simply 0.6 of the total passengers, that is $TP(K) = 0.6(TP)$. A comparison between $TP(K)$

and passengers in demand (K) portrays the performance of KBS (Table 5.3.2).

TABLE 5.3.2.: KBS PERFORMANCE

Yr	Daily Passengers ('000)		Difference (%)
	TP(K)	Pass in demand(K)	
1962	66	69	4.3
1972	88	90	2.2
1979	144	149	3.4
1981	175	184	4.9

Source: Based on TP column of Table 5.3.1 and Population column in Table 5.1.1

While 4.3 per cent of those in demand of KBS services in 1962 were not served, the percentage dropped to 2.2 in 1972. This could be explained by the increase in the number of buses during the period 1970-1973 and particularly 1971-1972 when the highest increase ever of 22.6 per cent was recorded. The inadequacy to serve those in demand rose to 3.4 per cent by 1979 as the company was confronted by double problems due to inflation and rapid matatu growth during the period 1973-1977. The effect was most severe during 1975-1977 as the number of buses decreased with a record growth rate of -1.1 per cent(section 5.5).

The Research and Planning office (1979) of the company asserts that since 1978, KBS has started a new phase of increasing its fleet strength to cope with the increasing demand. Some of the measures include vigorous research on the already existing schedules structure in order to rectify duplicated (or quasi-duplicated) journeys, and gaps filled; scheduling of additional off-peak services aimed at beating matatus. Despite the efforts to improve the services, the percentage not served is still on the increase. May be the measures are still in their initial stages to yield a substantial positive result.

Due to the consistent deficit of the supply, represented by percentage differences in the above table, the continued inadequacy of the services provided by KBS to meet the demand is quite contrary to and hence the rejection of the null hypothesis that 'The transportation services provided by KBS have been adequate to the demands from the high rate of the urban population growth'

Along the same line of assessment, the performance of both KBS and matatus can be reached. Assuming that the proportion in demand will remain at 32 per cent till 1985, the comparison follows (Table 5.3.3).

TABLE 5.3.3. PASSENGERS IN DEMAND vs TOTAL PASSENGERS CARRIED

	Proportion in Demand (%)	Daily Passengers(0 000)		Dj fference (%)
		TP	Passengers in Demand	
1962	20	66	69	4.3
1972	25	146	149	2.0
1979	30	240	248	3.5
1981	32	291	307	5.3

Source: Based on TP column in Table 5.3.1 and Population column in Table 5.1.1

With the earlier assumption that KBS provided all the services during 1962, the increased number of matatus from the early 1970s coupled with the additional KBS buses put on road during the same period combined to reduce the percentage of inadequacy from 4.3 in 1962 to 2.0 in 1972. As can be seen from the growth rates in section 5.5, while KBS company was busy re-scheduling their services hence affecting matatu operations, the number of total passengers in demand increased substantially hence raising the percentage of those who were not provided with the services to 3.5 in 1979. This percentage has been on the increase such that by 1981, it had reached 5.3 per cent. This could be

the result of the least growth rate in the number of matatus during the period 1979-1981 coupled with the overhaul in the KBS operations that was still in its infancy stages.

Although the percentage of those who commute on foot is on the increase, a similar increasing percentage is forced to use public transportation services due to the outwardly extending peripheral location of the residential areas. The percentages representing the deficit of the services (Table 5.3.3) confirms the hypothesis that with the present trends of urbanisation, the combined services of KBS and matatus still fall short of the urban public transportation demands.

5.4. Regression and Correlation Analysis

Regression and correlation analysis of the five variables was used to determine the relationship and influence between and among them. Since it was not clear which one of the five variables would remain dependent in respect to all other variables, each was treated successively as the dependent variable against the remaining four in the partial and multiple regression analysis.

5.4.1. Simple (total) Correlation

It was necessary to assess the degree of relationship between any two of the five variables. This becomes useful in comparing the trends of increase/decrease of the two variables in question. The degree of relationship also enables us to determine the proportion of the total variation in one variable as explained by the other. While the degree of relationship is referred to as the coefficient of correlation, r , the square of this correlation coefficient, known as the coefficient of determination, r^2 , represents the ratio of explained variation to the total variation in a particular

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variable. These two measures for all the pairs of the five variables have been calculated and tabulated below (Table 5.4.1).

The results suggest that for every pair, there exists a significant positive correlation: that is, for every increase in one, there is an accompanied increase in the other. The magnitude of the correlation is, however, varied as it ranges from 0.6880 to 0.9857. Taking $r_{35}=0.9857$, it reveals that the sharp increase in both matatu fleet size (x3) and passengers carried by matatus (x5) has

TABLE 5.4.1.: COEFFICIENTS OF SIMPLE CORRELATION

r_{12}	0.8326	0.6932	3.68**
r_{13}	0.9855	0.9712	14.23**
r_{i4}	0.7328	0.5370	2.64*
r_{i5}	0.9588	0.9193	8.27**
r_{23}	0.7452	0.5553	2.74*
r_{24}	0.7985	0.6376	3.25**
r_{25}	0.6990	0.4886	2.39*
r_{34}	0.6880	0.4733	2.32*
r_{35}	0.9857	0.9716	14.33**
r_{45}	0.7413	0.5495	2.71*
		df	6

** Statistically significant at better than 0.1 significance level

* Statistically significant at better than 0.5 significance level

df degrees of freedom

been unsurpassed by any other increase in any other pair. With $r_{3_}^2=0.9716$, it means that about 97 per cent of the total variation in the number of matatus is explained by the passengers they carry. The same percentage of explained variation occurs between population and matatu increase ($r_{,o}^2=0.9712$).

In so far as population increase sensibly explains 97 per cent of the increase in the number of matatus, it would appear quite illogical to claim that the same percentage of variation in population is explained by the matatus since population increase is independent of change in matatus.

The second lowest correlation coefficient ($r_{25}=0.6990$) is justified since we are comparing the number of KBS buses (x_0) which suffered a reduction during 1976 and 1977, with passengers carried by matatus which were always on the increase. Due to this, only 49 per cent of the total variation in the number of KBS buses could be explained by matatu passengers. The same is true also with the lowest coefficient ($r_{34}=0.6880$) since matatu fleet size was rapidly increasing while passengers carried by KBS went down for about four consecutive years (1974-1977). With the result that only 47 per cent of the variation is explained, the decrease in the KBS fleet size and hence in the passengers they carried can be rightly attributable to the rapid rise in the number of matatus at the time; but other factors such as inflation could have had their role in the decrease.

Though the simple coefficients of correlation are important in showing us the degree of relationship, they fail to indicate the aspect of causation and the magnitude of influence between and among the variables. For this, we turn to partial and multiple regression and correlation analysis.

5.4.2. Partial Correlation

Partial correlation yields a single measure summarising the degree of relationship between two ,
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variables, controlling for the other(s). ' By controlling the other(s), we want to ascertain whether or not the other variable(s) is (are) responsible for some of the correlation in the first two: that is, we want to know if some of the correlation in the two variables is spurious. Using the indispensable assumption of only one-way causation involved, the partial correlation between two variables, when the other(s) are controlled, will be reduced to near zero if the relationship between the two variables is spurious. We should note, however, that correlation does not automatically mean causation and causation cannot be inferred from correlation. All the same, correlation will mean a strong suggestive source of causation.

Since supply depends on demand, the two variables representing supply (KBS buses and matatus) will be taken as the dependent variables while population and passengers will be the independent variables. The partial correlation coefficients of the two dependent variables while controlling the other independent variables are represented below (Table 5.4.2.1). It is quite evident from the table that the smaller the simple coefficient of correlation, the larger is the reduction in the correlation between the two variables in Question. Taking the case where one independent variable is controlled, the decreases in every partial correlation coefficient confirms the results of simple correlation analysis that there is a strong intercorrelation between the variables. For the two cases of relatively smaller simple correlation (r_{25} and r_{34}), five out of the seven coefficients of partial correlation become negative after controlling the independent variables. Though at varying degrees, there is an element of spuriousness in each partial coefficient of correlation: that is, the simple correlation is produced by the fact that both independent variables are related to the same dependent variable and act in the same direction.

TABLE 5.4.2.1.: COEFFICIENT OF PARTIAL CORRELATION

Simple	r_{23}	0.7452	ଝଝ	0.7985	r_{25}	0.6990
	$r_{23.1}$	-0.8005	$r_{24.1}$	0.4999	$r_{25.1}$	-0.6319*
	$r_{23.4}$	0.4483	$r_{24.3}$	0.5907	$r_{25.3}$	-0.3162
	$r_{23.5}$	0.4664	$r_{24.5}$	0.5842	$r_{25.4}$	0.2649
	$r_{23.14}$	-0.7888	$r_{24.13}$	0.4596	$r_{25.13}$	0.1398
	$r_{23.15}$	-0.6432	$r_{24.15}$	0.8247	$r_{25.14}$	-0.8625
	$r_{23.45}$	0.9136	$r_{24.35}$	0.9278	$r_{25.34}$	-0.8987
	$r_{23.145}$	0.3427	$r_{24.135}$	0.7291	$r_{25.134}$	-0.6334
Simple	r_{34}	0.6880	r_{35}	0.9857		
	$r_{34.1}$	-0.2958	$r_{35.1}$	0.8453		
	$r_{34.2}$	0.2314	$r_{35.2}$	0.9746		
	$r_{34.5}$	-0.3772	$r_{35.4}$	0.9766		
	$r_{34.12}$	0.2011	$r_{35.12}$	0.7308		
	$r_{34.15}$	-0.8880	$r_{35.14}$	0.9663		
	$r_{34.25}$	-0.9049	$r_{35.24}$	0.9952		
	$r_{34.125}$	-0.8256	$r_{35.245}$	0.9195		

For example, since $r_{25}=0.6990$ **and** $r_{25\ 1}=-0.6319$, it means that population ($X^$) and **Dassengers carried** by matatus ($X^$), both independent variables, are related to the same dependent **variable**, KBS buses (X_2), and act in the same direction - hence the reduction of the correlation between $X^$ and $X^$ from 0.6990 to -0.6319 when X_1 is controlled.

In all but one of the five cases in Table 5.4.2.1, the influence of ponulation (X_1) on the fleet size of both KBS ($X_{,,}$) and matatus (X_3) stands out prominently over and above any other due to other independent variables. It stands out as an antecedent factor in influencing the dependent variables because whenever it is controlled, the resultant partial correlation coefficient is reduced significantly. This is not unusual due to the fact that both passengers carried by KBS and matatus are themselves dependent on the population.

5.4.3 Multiple Regression and correlation

Multiple regression attempts to predict a single dependent variable from any number (two and above) of

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the independent variables. Since total variation in any variable is due to several other variables, it appears logical that we identify all these

variables responsible so that the variation in the dependent variable is explained completely. However, it is almost practically impossible to identify all the variables due to various reasons such as time and financial constraints, complexity and non-quantifiable nature of some of the variables. Due to this, only some of the concerned variables are used in multiple regression and correlation analysis. After the choice of the number of variables to be dealt with, then multiple correlation is employed to indicate how much of the total variation in the dependent variable can be explained by all independent variables being used acting together.

Although other variables like monthly income of the passengers, fare increases could have been included, this study concentrated on the five variables outlined earlier in this chapter. By successively taking each of the five variables as dependent, the variations explained in each by the other four variables have been analysed and are represented as coefficients of multiple correlation (Table 5.4.3.1). The fact that 95 per cent and over of the total variation in each variable is explained by the remaining four shows that there exists a very high influence among the variables.

This suggests that the effect of the other variables that were omitted is relatively insignificant.

TABLE 5.4.3.1.: COEFFICIENTS OF MULTIPLE CORRELATION

	R	R ²	
R ₁ .2345	0.99734	0.99469	187.3 ^{**}
R ₂ .1345	0.97365	0.94799	18.2*
R ₃ .1245	0.99923	0.99846	648.4 ^{**}
R ₄ .1235	0.97711	0.95474	21.1*
R ₅ .1234	0.99847	0.99693	324.7 ^{**}

** Significant at better than 0.1 significance level

* Significant at better than 0.5 significance level

Though small, there exists a difference in the percentage of the variation explained among the variables as it ranges from 94.8 to 99.8 per cent. Delving in the already explained variation to determine the contribution of each of the independent variables, the results are summarised below (Table 5.4.3.2.). The variable which results in the highest simple coefficient of correlation with the particular dependent in question yields the highest percentage of explanation. In explaining the variation in the population (X_i), matatu fleet (X_{ii})

TABLE 5.4.3.2.: MULTIPLE REGRESSION: SUMMARY TABLE

DV	x_1			
INDV		R	R^2	Change (R^2)
	x_3	0.98546	0.97114	0.97114
	x_2	0.99642	0.99285	0.02171
	x_5	0.99684	0.99370	0.00085
	x_4	0.99734	0.99469	0.00100
DV	x_2			
INDV				
	x_1	0.83263	0.69327	0.69327
	x_3	0.94330	0.88982	0.19655
	x_4	0.95556	0.91309	0.02327
	x_5	0.97365	0.94799	0.03490
DV	x_3			
INDV				
	x_5	0.98567	0.97154	0.97154
	x_1	0.99587	0.99176	0.02022
	x_4	0.99913	0.99826	0.00650
	x_2	0.99923	0.99846	0.00020
DV	x_4			
INDV				
	x_2	0.79854	0.63767	0.63767
	x_5	0.83860	0.70324	0.06558
	x_3	0.97274	0.94623	0.24298
	x_1	0.97711	0.95474	0.00852
DV	x_5			
INDV				
	x_3	0.98567	0.97154	0.97154
	x_4	0.98951	0.97912	0.00758
	x_2	0.99799	0.99598	0.01686
	x_1	0.99847	0.99693	0.00095

INDV • Independent variable

and passengers carried by matatus (X^1), we realise from Table 5.4.3.2. that 97 per cent of the variation in each is explained by X^1 , X^2 and X_3 respectively. Only 2.4 per cent, 2.7 per cent and 2.5 per cent of the explanation in X^1 , X^2 and X_3 respectively is due to the effect of the remaining three variables in each case. The above high percentages of explanation agree with the simple coefficients of correlation since $r^{12}=0.9855$ and $r_{35}=0.9857$ were the highest of all the pairs.

We also notice from the table that the amount of explanation increases in each variable as more independent variables are involved such that we end up with the highest percentage of explanation by using four independent variables. This could be accounted for due to the fact that each pair of the variables had a high degree of positive simple correlation. From the percentages explained, X_2 had the lowest (94.8 per cent) followed by X^1 (95.5 per cent). Such an occurrence was expected since these are the only two variables (KBS buses and passengers they carried) which experienced negative growth rates for some time. This means that about 5.0 per cent of the total variation in these two variables was due to some other factor(s) not included in this study.

Concentrating on the fleet size of KBS and matatus as the rightful dependent variables, 95 per cent of the variation in the former and 99.8 per cent in the latter is explained. With 69 per cent of KBS fleet size variation explained by population alone, matatu fleet size come in next to explain 20 per cent such that the influence of passengers carried by KBS (2 per cent) and by matatus (3 per cent) is relatively insignificant. In contrast, the highest explanation (97 per cent) in the variation of matatu fleet size is achieved by the passengers carried by matatus with population explaining only 2 per cent with the KBS fleet size and the passengers they carry having nil explanation in the variation. This suggests that as matatus started providing services, the direct influence of the passengers (excess of what KBS could carry) overshadowed the influence due to the changes in population and KBS fleet size. The passengers matatus carried provided a ready market hence **t** a very high incentive in their increase which outweighed the effect from population increase and KBS buses.



Multicollinearity:

It refers to a linear dependence or correlation between two or more of the independent variables of a regression model. In an extreme situation, where it is perfect, it is quite impossible to distinguish between the way in which the values of a dependent variable are related to the independent variables hence the least squares estimator breaks down.

Inspection of a matrix of zero-order correlation coefficients provides only a limited check on multicollinearity except where there are only two regressors. A more general check is available in the determinant expansion of r , the matrix of zero-order correlation coefficients. This is referred to as the correlation determinant, $|r_{ij}|$, which has the boundaries 0 and 1. These boundaries demarcate the range between perfect multicollinearity ($|r_{ij}|=0$) and a total absence of any linear independence between regressors ($|r_{ij}|=1$).

An inspection of the matrix of zero-order correlation coefficients used in this study, shows that the coefficients ranged between 0.6880 and 0.9857. This may be suggestive of an element of multicollinearity. We test the strength of multicollinearity in the data by obtaining the

correlation determinant below:-

$$r = \begin{vmatrix} 1 & .8326 & .9855 & .7328 & .9588 \\ .8326 & 1 & .7452 & .7985 & .6990 \\ .9855 & .7452 & 1 & .6880 & .9857 \\ .7328 & .7985 & .6880 & 1 & .7413 \\ .9588 & .6990 & .9857 & .7413 & 1 \end{vmatrix}$$

The result shows that although there is an element of multicollinearity in the data, it is not that serious as to render the analysis null and avoid.

A Note on Multiple Regression Results

It is apparent that there exists a very high influence among the variables as at least 95 per cent of the total variation in each variable is explained by the remaining four variables. This high percentage of explanation in the dependent variables would suggest a perfect model (with almost 100 per cent explanation) which is not usual. However, this percentage is expected since the five variables are very much interrelated, for example, the number of passengers carried by both KBS and matatus is a proper subset of the Nairobi population. This is a pointer to the involvement of the problem of multicollinearity in the multiple analysis of the five variables. It should also be noted that R^2 (the ratio of explained variation to the total variation in a particular variable) is a non-decreasing function of the number of explanatory variables used i.e. as the number of explanatory variables increases, R^2 almost invariably increases and never decreases, as can be seen from Table 5.4.3.2.

Apart from multicollinearity, the error terms in the variables are involved in the analysis. These error terms include small measurement errors that

occur randomly in observing the dependent variable and the resultant of all the various causes of the dependent variable that have not been explicitly brought into the model. These have an effect on raising the values of their respective R_s (multiple regression results).

The problem of homoscedasticity may not be ruled out of this analysis. It was assumed that the variances of the error terms were constant across all levels of the independent variables. It was also assumed that for each regression equation, the variances of the resultant distributions (variances of the dependent variable for all combinations of the independent variables) were constant. Both these
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assumptions need not be true hence the chance of R being affected.

In spite of the existence of multicollinearity, some results in the model bear some strength as not
• to be dismissed outright. As long as multicollinearity is reasonable, estimation of the regression coefficients is possible. Although high multicollinearity may make it impossible to isolate the individual effect of the explanatory variables, we can observe the effect of each variable stepwise in this case. In trying to

relate demand and supply of urban public transport, **we** look at the fleet size of KBS and matatus as the dependent variables (supply) while population, hence the passengers carried[^] as the independent variables (demand). From Table 5.4.3.2., KBS fleet size (X_2) as the dependent variable has 69 per cent of its total variation explained by population ($X^$). In the next step, when matatu fleet size (X_3) is brought in, the change in R^2 is about 20 per cent—given that $X^$ is also a dependent variable, then it is suspect for multicollinearity with respect to $X^$. Passengers carried by KBS ($X^$) and those carried by matatus ($X^$) only explain 2 and 3 per cent of X , respectively.

Of the total variation in X . (an independent variable), about 64 per cent is explained by X_2 (a dependent variable) yet X_4 explains only 2 per cent of the variation in $X^$. If the services offered by KBS had been adequate for the demand, the rise in demand and supply would be expected to be proportional hence a higher percentage (not 2 per cent) expected also. A look at Table 5.3.2. shows that there has been a consistent deficit in supply relative to demand for the period 1962-1981. These two results contradict the hypothesis that supply of services by KBS has been adequate for the urban population's demand.

While X^{\wedge} explains 20 per cent of the variation in X_2 offers nil explanation in X^{\wedge} . From Table 4.4.1, the variation in X_2 was negative as per performance since its market share was on the decrease for the period 1973-1979 while there was a marked increase in the market share in X^{\wedge} for the same period. This is quite in line with the hypothesis that the emergence and continued increase of matatus negatively affected the performance of KBS.

The above multiple regression results should be treated cautiously since they involve problems peculiar to multiple regression. Due to this, none of the results was used to test any hypothesis. All the same, they throw some light as per the association between the variables representing demand (X_4 and X_5) and those representing supply (X_2 and X^{\wedge}).

5.5. Future Outlook

While the population growth trend has been consistent, growth trends in both fleet size and passengers have been fluctuating (Table 5.5.1, Appendix A). Due to this haphazard manner in the trends, projections for 1985 only will be computed since projections beyond this could be deceitful. The aim of the projection is to find out whether or not the expected number of passengers in demand will march the expected number of passengers that will be actually carried. Although we could simply use data on passengers to arrive at the expected number of passengers that will be carried, it is important to note that this expected number of

passengers is dependent on the expected fleet size. We have to project for the 1985 fleet size and hence the number of passengers to be carried. Since data on matatus is only available as of 1971, the projections will be based on data as from 1971. Though the average growth rate of the matatus has been 25.8 per cent per annum, the current downward trend suggests that it may stabilize somewhere in the region of 10 per cent per annum but for the purpose of projection, a 20 per cent rate of growth will be used. It is assumed that the total population will maintain a 5.0 per cent per annum growth rate up to 1985. As well, it is assumed that the level of demand for public transportation services will remain constant from 1981 to 1985 at 32 per cent of the total population. Lastly, the fact that 0.4 and 0.6 of the total passengers are carried by matatus and KBS respectively is assumed to hold even in 1985. The summary of the **projections are presented in Table 5.5.2.**

TABLE 5.5.2: PROJECTIONS: SUMMARY TABLE*

	KBS	Matatus
Average growth rate (%) p.a.	6.5	20
Average fleet size.	273	980
Average daily passengers.	236,287	120,548
Average daily pass, per bus/matatu	866	123
Fleet size in 1985.	424	2484
Daily passengers in 1985.	381,906	305,532

* Based on Table 5.5.1.

Using the data in the above, we now relate the expected demand and supply (population and passengers in thousands).

Demand:	32 per cent of total population in 1985 at 5.0 per cent per annum	= 375
Supply:	$0.4(306)+0.6(382)$	= 352
Difference		23

This suggests that of the 375 thousands who will be in demand of the public transportation services, 6.1 per cent ($23/375 \times 100$) will miss them due to inadequacy. If the present trends in the supply of public transportation services are continued into the future, then the above deficit of 6.1 per cent agrees with the hypothesis that 'the combined services of KBS and matatus are expected to fall short of the demand in the near future with the present trends'.

CHAPTER VIIMPLICATIONS, SUMMARY AND RECOMMENDATIONS

The effort to satisfy transportation demand has various significant implications. These implications are economic, social and environmental and have been directly or indirectly echoed in earlier chapters of the thesis.

This chapter explores the net effect of the prevailing situation where the transportation services provided are inadequate to the demand coupled with the eminent disorganisation in matatu operations. With the implications at hand, the summary of the study is presented together with the contributions of the study. Recommendations concerning the urbanisation process and the nature of public urban transportation services provided as well as opportunities for further research will be offered.

6.1. Implications due to the effort to meet increased demand for public transportation services

Before considering the implications, a short overview of the nature of population distribution and the conditions of major roads to the east of the city centre is presented.

6.1.1. Spatial Distribution of Population in Nairobi

As was pointed out earlier in chapter 1, most of the population is concentrated to the East of the city centre. With the 1979 census data", this area (Eastlands) with about 17 wards then, had an aggregate population of 372,141 which represented about 45 per cent of the total population of Nairobi in the same year. This dominance is expected to continue into the future as the Nairobi City Council, Planning Department (1981), asserts that the future extension⁰ for the whole of Nairobi is linearly-running from the East and North-East to the South-west via the city centre. However, most of these future extensions are towards the East because: it is easier to obtain land plots in the East because there are large tracks of it contrary to the small plots in other surrounding areas; the resistance to tamper with the coffee farms towards the North; and the Government's opinion to retain the parks towards the South. Among the already planned expansion projects include Dandora Community Development Project to provide 6,000 plots to accommodate a population of approximately 60,000; Mathare North Development Project for 1,500 units (about 15,000 persons);

Kayole Project near Dandora to have 3,000 units (30,000 persons); Soweto Project at Embakasi with 3,000 units (30,000 persons) and Umoja Phase 11 Project with 2,500 units (25,000 persons).⁵⁷

Assuming a 5.0 per cent per annum population growth rate together with the new population increases above (the expansions are supposed to be through by end of 1985), population projections in these areas have been calculated (Table 6.1.1) for the years 1985 and 1990.

table 6.1.1 : population projections for some wards to the east

Ward	1979 ^a	1985	1990
Dandora	22 672	90 604	116 338
Eastleigh	53 562	72 301	92 836
Embakasi	13 502	48 226	61 923
Kariobangi	43 349	58 515	75 135
Mathare	68 456	107 406	137 912
Umoja	25 000	58 747	75 432

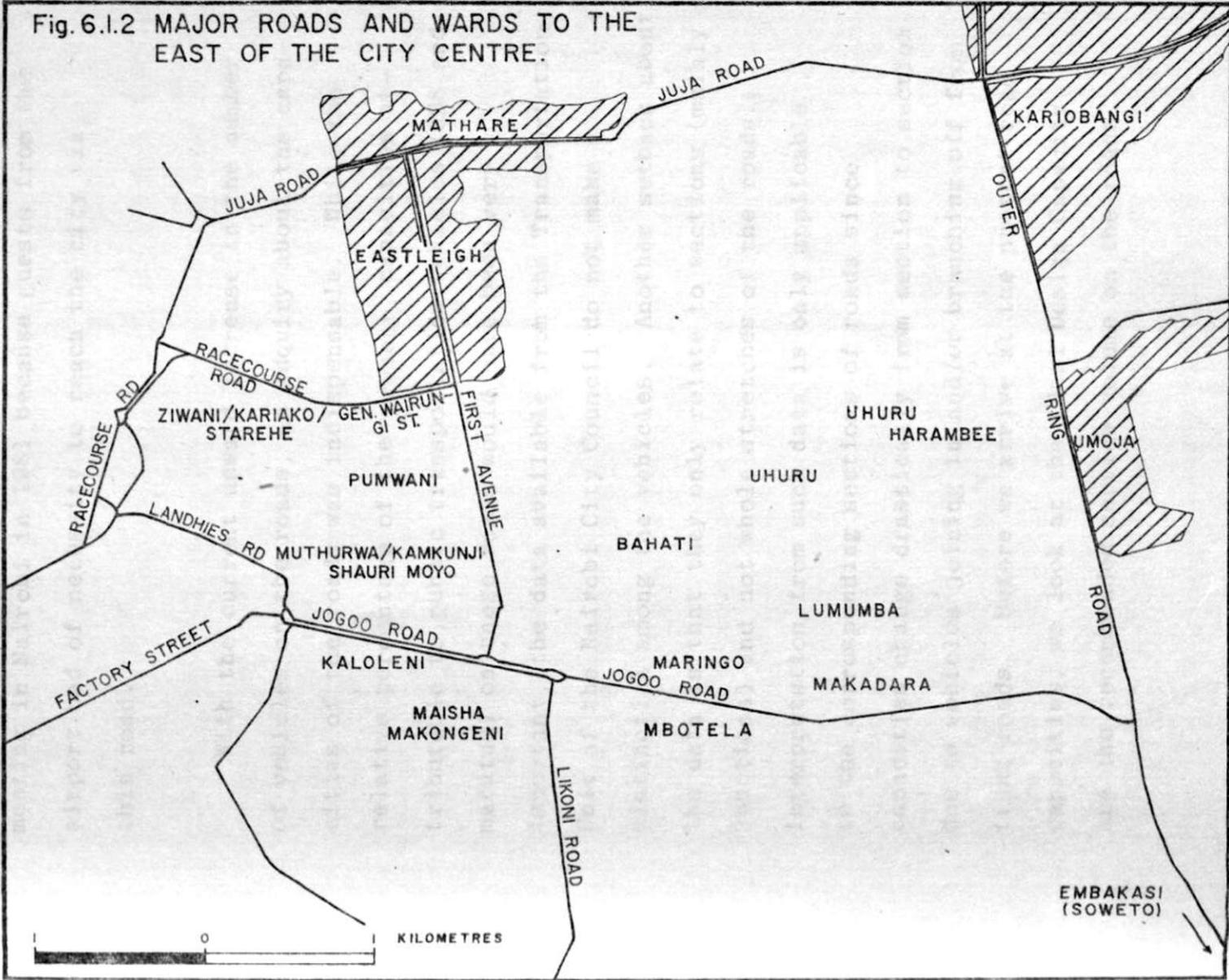
Source: a Republic of Kenya, Kenya Population Census, 1979.

The double effect of the expansion and natural increase in the wards to the East is expected to yield an approximate population of 0.7 million in 1985. When compared to the expected total population of 1.2 million, this amounts to about 58 per cent of the total population residing to the East of the city centre by 1985. This domineering effect necessitates special attention as concerns the conditions of major roads in the area.

6.1.2. Conditions of Major Roads to the East of the City Centre.

As can be seen from Figure 6.1.2, all the people to the East are served by two main roads to and from the city centre: Jogoo Road and Juja Road. Other important roads include General Waruingi Street, Race-Course Road, Landhies Road and 1st Avenue Eastleigh. Roads built by the Nairobi City Council are meant to last 20 years. With Juja Road having been built in late 1950s and part of Jogoo Road (towards Outer Ring Road) in early 1960s, it is clear that these two are long past their life-times. Their present condition is due to the repeated haphazard patching in various sections where pot-holes occur and recur. The last major patching

Fig. 6.1.2 MAJOR ROADS AND WARDS TO THE EAST OF THE CITY CENTRE.



exercise was on Jogoo Road prior to the OAU Summit meeting in Nairobi in 1981 because guests from the airport had of necessity to reach the city via this road.

With the current upward increase in the number of vehicles on the roads, an inquiry about the capacities of the roads was indispensable. While the relative percentage of the present capacities attributable to public transportation vehicles (KBS and matatus) on these roads would have been very important, the data available from the Transportation Unit of the Nairobi City Council do not make a distinction among the vehicles. Another setback about the data is that they only relate to sections (mainly junctions) and not whole stretches of the roads. Interpretation from such data is only applicable to the corresponding sections of roads since capacities change drastically from section to section due to vehicles joining in and/or branching off from trunk roads. Before we arrive at the present road capacities, we look at the Ideal Design Capacity and the recommended service volume on the roads.

Nairobi City Council records show that all urban roads should have an Ideal Design Capacity of 1500 vehicle per hour (vph) per road (or per lane for multilane roads). Because of various intervening variables, this ideal condition is never realised hence we have a Normal Design Capacity that should be about 75 per cent of the Ideal Design Capacity. Since the capacity carried should not exceed the Normal Design Capacity, the recommended service volume should be less than or equal to 75 per cent of the Normal Design Capacity. That is:

Ideal Design Capacity = 1500 vph

Normal Design Capacity = $75 \times 1500 = 1125$ vph
100

Service volume should be 75 per cent of
 Normal Design Capacity

$75 \times 1125 = 845$ vph
100

This means that on any road or lane where we have more than 845 vehicles per hour, there is likely to be overloading. Capacities as of March 1982 of some sections on the roads to the East of the city centre are tabulated below (Table 6.1.2). The two sections on Juja Road have capacities that have exceeded the required capacity. Though data

TABLE 6.1.2. : ROAD CAPACITIES TO THE EAST OF THE CITY CENTRE (1981)

Road	Time (Peak)	Capacity not to be exceeded (vph)	Present Capacity (vph)	Excess over or Deficit to average (845)
Landhies (Jogoo Round-about)	Morning	845	750	- 95
	Evening	"	700	-145
Jogoo (Landhies Round-about)	Morning	"	702	-143
	Evening	"	640	-205
Juja (Before 1st Avenue Eastleigh)	Morning	"	923	+ 78
	Evening	"	845	0
Juja (After 1st Avenue Eastleigh)	Morning	"	984	+139
	Evening	"	913	+ 68
1st Avenue Eastleigh (Juja junction)	Morning	"	435	-410
	Evening	"	481	-364
1st Avenue Eastleigh (Before General Waruingi)	Morning	"	809	- 36
	Evening	"	728	-117
1st Avenue Eastleigh (Afer General Waruingi)	Morning	"	577	-268
	Evening	"	580	-265
General Waruingi Street (Before 1st Avenue Eastleigh)	Morning	"	562	-283
	Evening	"	605	-240
General Waruingi Street (After 1st Avenue Eastleigh)	Morning	"	1154	+309
	Evening	"	1011	+166

Source: Based on data from Nairobi City Council, Transportation Unit, March 1982

- 'Before' is used here to indicate approach from the City Centre
- 'Peak' refers to the peridos before 9.00 a.m. and after 3.30 p.m.

are lacking on other sections of the same road, an eye's observation suggests an already dilapidated state of the road characterised by numerous pot-holes and the erosion of the kerbs. A section of General Waruingi Street just after 1st Avenue Eastleigh also carries more vehicles than required. These two sections call for immediate attention or else the extent of damage will go beyond the point of repair. Other sections of some roads, for example Jogoo Road, are also tending to the saturation level hence the need to take preventive measures. Despite these sure signs of some parts of roads being overloaded, the Senior Assistant Planning Officer in the Planning Department, Nairobi City Council, says that there are no definite plans to construct new roads to many parts of the city except for estate roads when a new estate is established (personal communication).

6.1.3 Implications

The relationship between demand and supply of public transportation services, in an effort to strike a balance, results in varied implications. These implications do affect individuals' lives, roads, vehicles and the environment at large. Some of these are briefly looked at below:

Of the total trips, those made on foot are estimated at about 25 per cent (Nairobi Urban Study 58 Group, 1972). Like migratory patterns, these 'footers' have formed their own particular paths to and from the Industrial Area especially. Streams of the 'footers' are a common feature during early morning and evening with Kibera, Kariobangi, Kawangware as the major donors. The grim decision to start footing may partly be a consequence of the individual's inability to meet the ever increasing fares and partly due to the fear of getting to work late (the majority of them being casual workers) as a result of the daily traffic jams at peak hours. The worry of waking up early and the sheer physical fatigue due to the walking have a negative bearing on their working efficiency hence a negative effect on the economy. For those whose residential places are far away from their places of work, examples include Embakasi, Dandora, Riruta, it means that an increasing proportion of their income has to be spent on transportation.

With the supply lagging behind demand, it is indispensable that vehicles have to be congested at peak periods. This congestion within the vehicles contributes to increased pick-pocketing; reduced

vehicles' life-time because of the high rate of depreciation: matatus deteriorate quickly since they are not built to withstand the overloading hence it is estimated that their maximum life time

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is two and half years (NCC, 1980) The high depreciation rate accentuates the likelihood of accidents occurring. From the end terminals, the struggle starts by a battle from people trying to secure a place in vehicles. The array of discomforts such as being pushed, trampled on, stooping in matatus and hanging onto doors continues until the end of the journey^

The sharp increase in the number of vehicles, particularly matatus, with no corresponding increase in the construction and improvement of roads has meant roads being overloaded. This reduces the life time of roads with pot-holes a common sight. Congested roads decrease travelling speed with so many man-hours lost due to traffic jams. The poor state of roads, overloading of vehicles and the rushing of matatus to pick passengers help to increase the number of accidents on our roads.

With over 1,700 people who died in road accidents in 1981 in Kenya, it means that at least 5 people were killed on our roads every day yet we had 31 persons injured every day in the same year (Daily Nation, May 20, 1982).^{CC\}

The Presidential Decree and the existence of potential customers due to the inability of KBS to meet the demand have resulted into a large number of matatus being put on roads with no prior plan in their operations. The inability of concerned authorities to control matatus has yielded chaos in way of parking in town: matatu operators have taken unto themselves the responsibility as to where they should park and where to stop picking their passengers. Easy movement for pedestrians, especially, is hampered as the footways have become parking lots for matatus.

The existing large matatu fleet size corresponds with the number of people including the unemployed, being hired as drivers and conductors for the matatus. The high depreciation rate experienced by matatus warrants more mechanics in the increasing number of open-air garages where almost all matatus are taken for repairs.

The figure amounting to 16,000-22,000 jobs

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(Coopers & Lybrand, 1980) as the direct and indirect employment generated by matatus, is expected to continue rising since services from matatus have to be appreciated circumstantially. However, loss of revenue to the Government is a negative effect since profits from the matatu operations are not taxed. These job opportunities within the operation may be a lure to job-seekers hence an inducement to increased rural-urban migration.

It has dawned on many that studies in the provision of urban public transportation services are necessary. Some of the various institutions that have launched studies in this area include the World Bank (Public Transport in Nairobi, 1981), Mazingira Institute (Matatu Mode of Public Transportation in Nairobi, 1980), KBS Company (Operations with Matatus, 1979), and the Government, through the Kenya National Council for Science and Technology (Science and Technology for Development, 1980). Together with trying to alleviate the shortage of the services, the studies also aim at finding ways and means of saving/conserving fuel and controlling matatus effectively.

6.2. Summary of the findings

It was the aim of this study to consider Nairobi's trend of urbanisation, how it relates to demand and the extent to which this demand for public transportation services is met in Nairobi. Following is a summary of the main findings of the study.

Urbanisation rate, about 5 per cent and over, is considered high as it is over and above the national population growth rate estimated at about 3.9 (1979) per cent per annum. Perhaps a positive sign to the Government's policy to decentralise urbanisation, there has been a drift of the process away from Nairobi and Mombasa towards the smaller towns between 1969 and 1979.

Of this high urban growth, rural-urban migration accounts for a higher percentage over the contribution due to natural increase. Though 74.4 per cent of the 1979 Nairobi population consisted of migrants, the share of rural-urban migration is showing signs of decline though it is expected to continue exerting an overriding effect over natural increase. By the year 1985, Nairobi's urban population is expected to have 50 per cent

and over as migrants while this share should drop to, at least, 40 per cent by the year 2000. It has been, and still is, Government's policy to restrain this movement to urban areas. An earlier effort towards this end through the Vagrancy Act (1968) was unsuccessful. Various problems connected with planning and implementation retard the Government's effort to effectively decentralise the urbanisation process. Among others are: the gap between planners and policy makers and the dependence on foreign investors who always favour the already developed major urban centres. These setbacks in decentralisation go in to increase the demand for public transportation services in the major urban centres.

From this urban growth, due mainly to rural-urban migration, demand for public transportation has also been on the increase. Even though the KBS had started by 1934, the inadequacy to provide the needed services persisted until 1973 when matatus were legalised to operate as public carriers. Of the 69,000 potential passengers, KBS was able to ferry only 66,000 passengers hence a 4.3 per cent

deficit of the services in 1962. This deficit amounted to 2.2 per cent in 1972 as the increase in the number of buses had a record of 22.6 per cent between 1971 and 1972.

With the Presidential Decree (1973) that legalised matatu operations, matatus brought with them chaos in every aspect of their operations. Matatu operations are characterised by unpredictable, erratic, random behaviour in terms of their time, route and fare. This is so because matatus are in the informal sector of the economy where there is limited regulation. This state of affairs still prevails unabated though efforts by the Government, the Nairobi City Council and the Matatu Operators Association to effectively control matatu operations have not succeeded. Some of the measures to be undertaken include a compulsory acquisition of a Third Party Insurance Policy by every operator, . setting up of matatu bays in the city centre and mandatory inspection every six months or twice a year.

The legality of the matatu operations, together with the ready market due to the inability of KBS to provide enough services, lent a hand to increase the matatu market-share from 16 per cent in 1973

to 42 per cent in 1979. Other than being treated as competitive, matatu services have to be seen as complementary to those of KBS. This is as a result of the passengers they carry (250,000 daily, 1981) and their flexibility in their operations, for example, the possibility of penetrating services into areas with constrained road networks where KBS would possibly not venture to operate.

The high increase in the number of matatus was matched by a corresponding increase in the number of passengers they carried (correlation coefficient= 0.9857). This, together with financial constraints, resulted in KBS and the passengers they carried (correlation coefficient= 0.7985) experiencing negative growth rates between 1973 and 1976. In an effort to outdo the matatus, KBS has embarked on serious research into matatu , operations coupled with various changes aimed at improving their own services. Due to these, it seems matatus are about to reach some form of saturation in their growth rate and hence have to evolve some subtle ways in order to co-exist alongside KBS.

The existence of matatus has meant the expansion of the informal sector of the economy. More and more of the unskilled and semi-skilled workers are engaged in matatu-affiliated jobs since more matatus are put on the roads; and open-air garages spring up every now and then. However, some of the drivers hired are in-experienced and, as a result, the death toll on our roads has been on the increase. The number of direct and indirect jobs involved was as high as 22,000 by 1980.

The nature of the spatial population distribution in Nairobi has the urban poor being pushed onto the periphery. This fact, combined with the annual increases in the fare ranging between 14 per cent and 40 per cent (1971 to 1982), means that people have to spend more on transportation. Since the meagre salaries of the urban poor are not commensurate with these fare increases, many are forced to walk to and from their places of work.

The present (1982) KBS fare function, $Y=100+12X$, means that a passenger has to pay 100 cents irrespective of the distance travelled and then 12 cents per extra kilometre travelled.

Although the relative cost per extra kilometre travelled decreased with distance in the whole fare function, the reverse was true when the variable component was considered. Eventually, people who live farthest end up paying more per extra kilometre travelled relative to those who stay near the city centre.

The positive correlation between the number of buses serving various population concentration pockets in Nairobi and the population in these pockets (correlation coefficient = 0.54) was not as high as expected. It is thought that this is due to some important intervening variables such as, the proportion of people who use the buses in each of these pockets; intermediate population that is served by the same buses before reaching the destination; and, time interval between one bus and the next on different routes.

Since matatus started operating, the usage of KBS and matatus by passengers has had mixed results whereby in 1982, we had a mixed usage in the ratio 6:4 for the KBS and matatus respectively.

The combined supply of transportation services from KBS and matatus still fall short of the demand by 5.3 per cent (1981). This deficit of the services is expected to continue in the near future with a projected 6.1 per cent deficit by 1985. Many circles, among them the World Bank (1980) and Kenya National Council of Science and Technology (1980), feel that the inadequacy of the services is partly to blame on the monopoly of the private sector in the provision of transportation services for its objective of maximising profits.

Five variables, namely, population, KBS buses, matatus, passengers carried by KBS and passengers carried by matatus in Nairobi were used in this study. Correlation analysis showed that 95 per cent and over of the total variation in each variable was explained by the remaining four. This implies that there exists a strong influence among the variables hence the insignificance of the other variables that were omitted. As matatus started operating, the direct influence of the passengers they carried overshadowed the influence due to changes in population and KBS. Of the 99.8 per cent of the explained variation in matatus,

Matatu passengers accounted for 97 per cent. Conversely, of the 95 per cent explained variation in KBS buses, 69 per cent of it was accounted for by population changes and 20 per cent by matatus.

Because of increased demand, the problem of double congestion arises since both vehicles and roads are overworked, especially at peak periods. This congestion increases the chances of traffic jams and road accidents through pot-holing and high depreciation rates of vehicles. Some roads, especially Juja Road, have not only exceeded their projected economic life but are also carrying vehicle capacities that far exceed the required capacity.

Though there is an interrelationship between urbanisation and the supply of transportation services, it is the former that induces the demand for such services. Even if we ideally assumed that all gates were closed to potential migrants to Nairobi, we still have to solve the already existing problem of providing sufficient and efficient transportation services. This means that

solutions that are both short- and long-term have to be reached to effectively reduce the magnitude of the problem. While we effect long-term objectives to stem the rural-urban drift, short-term solutions and long-term planning strategies in the supply of transportaion services are long over-due. It is hoped that the experience in Nairobi will serve as a stepping-stone whereby proper planning for fast growing towns such as Kisumu and Nakuru is achieved.

6.2.1. Contributions of this study

In a bid to relate the urbanisation process and the nature of the public urban transportation system in Nairobi, the study has come up with a few observations, presented below. These observations are expected to shed some light on the remedial and prevention actions needed.

- a) The root cause of the major transportation problems is a direct result of the high urban growth due mainly to rural-urban migration. In order to curb this drift to urban areas, comprehensive research has to be undertaken to reveal the social, cultural and economic reasons underlying the dfi^-

- b) Due to the prevailing chaotic situation created by matatus, proper organisation and control of matatus and urban transportation system as a whole is long over-due hence the proposed framework for Urban Transport Authority to be responsible for all matters concerning the adequacy and efficiency of urban transportation systems (Figure 6.3).
- c) Apart from the population sizes in various wards, there are other variables that influence the number of buses that serve different wards.
- d) Passengers use KBS and matatus interchangeably depending on the prevailing circumstances in which they find themselves. These may include convenience, fare, speed and other related issues. It has been found that in 1982, 60 per cent of the journeys are made by KBS while the rest by matatus for those who use either KBS or/and matatus. From this,

a formula for the total passengers was derived (see formula (ii) on page 115).

Supply of transportation services (KBS and matatus) has lagged, is and is expected to continue lagging behind demand at least up to 1985. This calls for comprehensive improvements in the urban transportation system in a bid to meet the demand.

That the urban poor are hardest hit by the ever increasing bus-fares, an evaluation of the fare-structure of KBS was very necessary. A 1982 fare function of the form $Y=100+12X$, established that the cost of an extra kilometre travelled tapers off with distance. However, the cost of an extra kilometre travelled increases with distance if the variable component is considered. This means that the farther one goes, the more one has to pay per extra kilometre. This seems quite unfair to the urban poor who happen to live farthest.

- g) From a cursory observation, most roads in Nairobi look to be in good condition. Most of the junctions in the city centre, the whole of Juja Road and sections of Jogoo Road are overloaded hence improvement is called for. Juja Road needs immediate attention in terms of re-building the whole road since it is long past its life-span.
- h) The situation in Nairobi, from this study, should sound as a warning to other towns in Kenya that are rapidly urbanising so that they take appropriate precautions before they end up with the same or even worse problems.

6.3. Recommendations

The following recommendations concern the two aspects of urbanisation and urban public transportation. It is hoped that they should go some way in curbing the rate of urbanisation, particularly in Nairobi, and improving the present state of urban public transportation. While the short-term measures are supposed to cure an already existing problem, the long-term measures are intended to be preventive of such problems, especially in other towns that

have started growing rapidly.

A feasible integrated rural-urban strategy, based on general policies to reduce distortions and a deeper evaluation of identifiable practical alternatives for both rural and urban development, appears quite productive. This should include the creation of small towns that are crucial both for the provision of services to the rural areas themselves and to the absorption of potential urban migrants.

It is imperative that we relate urban planning and programming much more closely with municipal budgets and decision makers. General objectives and financial allocations can then, from the start, condition the programming effort making it more realistic.

A concerted effort by the Government is called for to try and limit the influence of investors in the decisions of industrial location. Donors with the minimum and less stringent conditions should be the ones to be welcomed.

Wage differentials should be eventually removed so that higher wage incentives cease to exist as a factor in the influx of migrants to urban areas.

As the basis of limiting the urbanisation process in major urban centres, there should be intensive and continuous research on the key aspects of urbanisation. This will provide a guide to improved policies and programmes. Research should also be undertaken to establish why some smaller centres have stagnated. The results can provide direction in future growth centre strategy. While planning for these small towns, the aspect of urban public transportation should be incorporated right from the start.

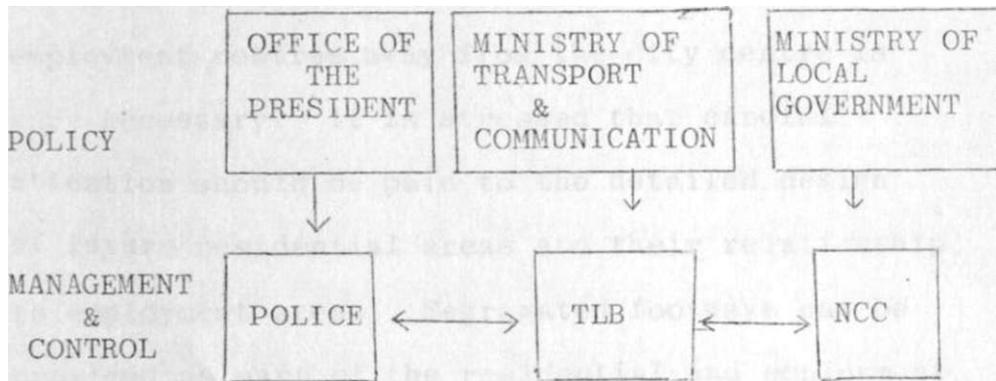
As attempts are made to improve matatu services, it is obvious that the menace of matatus on roads has now gone beyond the police. Matatus should be treated as any other big business and made to comply with all the conditions that apply to all other commercial and public service vehicles.

This will stimulate wider acceptance among the public so that the reciprocal respect due to matatus is accorded. Perhaps the biggest headache with matatu operations is the enforcement of the laws and regulations. It is proposed that the Government together with NCC should formulate an urban transportation policy. The management and control of those who provide the services should be placed under a properly defined and structured authority which will coordinate all matters pertaining to urban transportation. The structure could assume the one suggested in Figure 6.3.

' Functions would be as follows:-

The Policy Board shall be the final authority on all policy matters pertinent to urban transportation. This Board will relate such policies to the national policies on transportation. It will ensure an effective and efficient urban public transportation system. Management and Control Board shall regulate and control the relationship between the road space and vehicles and also between these vehicles and various road users. It shall carry out the functions of routing, re-routing and making arrangements for

FIGURE 6.3.: STRUCTURE OF THE URBAN
TRANSPORTATION AUTHORITY



* TLB - Transport Licensing Board

terminal and bus stops. This Board should also ensure exclusive matatu stations within the city and also ensure that matatu operations are in compliance with the Traffic Act (1962), related rules and regulations.

Immediate road improvements are called for on Juja Road and some sections on Jogoo Roads as the required capacity of 845 vehicles per hour is exceeded at peak periods. Alongside, more traffic controls should be installed at various junctions within the city centre. Of the various junctions, Landhies/Ring Road Pumwani, Koinange/University Way, Harambee Avenue/Taifa Road need traffic lights.

With the current pattern of spatial distribution whereby the urban poor are being pushed on the periphery, the process of decentralising employment centres away from the city centre is very necessary. It is stressed that careful attention should be paid to the detailed design of future residential areas and their relationship to employment areas. Segregated footways can be provided as part of the residential and employment areas development.

In a bid to save/conserve fuel, we can introduce oil conservation measures such as restructuring of the transport system, introduction of diesel-operated vehicles, school-bus system, introduction of a five work day week and provision of mass transport by companies having: a large number of employees.

Lastly, it is strongly recommended that research on the long-term needs of urban transportation in relation to the rate of urbanisation be undertaken vigorously.

Future Research Opportunities

Urban transportation has many areas of investigation that a single study like this one may not be able to explore in full. All direct and indirect factors that influence urban transportation have to be identified and the nature of the influence analysed. The following aspects need to be investigated so as to facilitate the improvement of urban transportation.

A comprehensive study to relate public urban transportation with the general transportation system together with housing programmes and location of industries. This calls for an inter-disciplinary approach if we have to save on time and money.

A study in the nature of matatu operations - both economic and social aspects as they relate to drivers, conductors and users of matatus. Such aspects as fleet size, travel speed, fare-structure, profit levels, fuel consumption, income levels should be considered.

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A study in the nature of matatu operations - , both economic and social aspects as they relate to drivers, conductors and users of matatus. Such { aspects as fleet size, travel speed, fare-structure, profit levels, fuel consumption, income levels should be considered.

A detailed study on the relationship between KBS and matatus in terms of their everyday operations so that they co-exist to provide efficient and sufficient services. In order of importance, all determinants that dictate the direction and volume of KBS and matatus should be revealed.

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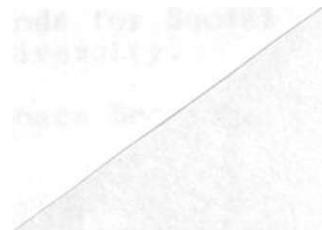
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a p p e n d i x

Table 2 12 NAIROBI POPULATION GROWTH RATES,
1979-1985.

	Overall	In-migration only
1971-74	6.9% p.a.	6.0% p.a.
1975-79	6.7% p.a.	5.0% p.a.
1980-84	6.0% p.a.	4.0% p.a.
1985	5.4% p.a.	3.0% p.a.

Source: Nairobi Urban Study Group; "Nairobi-Metropolitan Growth Strategy", Volume 2, Table 2.12, 1973.

Table 3.1. URBAN POPULATION (QQQ). 1948-1⁰

	1943	1962	1969	1980
Urban population	276	671	1083	2200
% of total population	5.1	7.8	9.9	15.1
Nairobi population	119	347	509	913
% of urban population	53	52	47	42

Source: Shah, M.; Rural-Urban Population Projections for Kenya and Implications for Development, 1978, Table 25 pp 51.

Table 3.1.5(a) KENYA: URBAN POPULATION (+5j)

	1948	1962	1969	2000	
				Low	High
Total	252 645	619 656	998 189	6797 300	9152 600
Nairobi	118 976	227 072	509 286	2883 200	4200 000
% of Nairobi's total	47.10	43.1	51.02	42.42	45.89

Source: P.A. Memon, Urban Primacy in Kenya
Table 3 pp 32, 1975.

Table 3.2.2. LOW PROJECTION: NAIROBI AFRICAN
!POPULATION INCREASE

	Increase by natural growth	No. of migrants	Total increase
1969-74	60 700	156 500	217 200
1974-79	104 400	204 400	308 800
1979-84	155 000	245 000	400 000
1984-89	214 300	253 000	467 300
1989-94	270 100	208 700	478 800
1994-99	307 800	117 000	424 800
1999-2000	67 000	24 500	91 500
Total	1179 300	1209 100	2388 400

Source: Nairobi Urban Study Group; Nairobi-Metropolitan
Growth Strategy, Volume 2, Table 1.8,1973.

Table 3.2.3. HIC-H PROJECTION: NAIROBI AFRICAN POPULATION INCREASE.

	Increase by natural growth	No. of inmigrants	Total increase
1969-74	60 780	156 500	217 280
1974-79	104 400	213 600	318 000
1979-84	156 400	293 200	449 600
1984-89	220 700	401 900	622 600
1989-94	316 500	500 900	817 400
1994-99	418 200	614 000	1032 200
1999-2000	108 800	138 900	247 700
Total	1385 780	2319 000	3704 780

Source: Nairobi Urban Study Group; Nairobi-Metropolitan Growth Strategy, Volume 2, Table 1.9,1973.

TABLE 5.5.1. KBS AND MATATUS: FLEET AND PASSENGERS
WITH THEIR GROWTH RATES

KBS				
Year	Fleet ^a	Rate (%)	pass ^{^000)}	Rate ^{e C &)}
1962	100	3.0	66	2.2
1964	106	9.4	69	12.8
1968	146	6.8	115	13.6
1970	166	17.5	151	32.5
1971	195	22.6	209	10.9
1972	239	10.5	233	3.0
1973	264	7.6	240	-1.3
1974	284	2.1	237	-3.0
1975	290	-0.7	230	-0.4
1976	288	-1.1	229	0.0
1977	285	2.1	229	8.8
1978	291	8.9	250	7.7
1979	317		270	

Matatus				
Year	Fleet ^a	Rate (%)	pass ^{^000)}	Rate
1971	217	36.4	38	10.6
1973	375	43.5	47	29.3
1974	538	30.1	63	16.1
JL975	700	38.4	74	31.1
1976	969	36.2	101	32.7
1977	1320	8.6	140	15.8
1978	1434	9.3	164	17.3
1979	1567	4.2	195	15.0
1981	1700		263	

a Based on Table 5.1.1.

appendix b

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Households Questionnaire

Date: _____ House No. _____

Ward _____

1. Which of the following do you own?

Car Q = 1 Bicycle = 3

Motor-bike ● None = 4

2. Which is the safest and most comfortable way to travel?

KBS Bicycle

Matatu Walking

Private car - 3

3. What kind of transport do you usually use?

KBS = 1 Motor-bike

Matatu = 2 Bicycle

Company car = 3 Walking

If the respondent uses either KBS or matatu, ask:

3(a) **Approximately** how many times in a week do you use KBS?

once	= 1	five times	
twice	= 2	six	6
thrice		seven	= 7
four times	= 4		

3(b) **Approximately** how many times in a week do you use matatu?

once		five times	\ j = 5
		"	
twice		six	
thrice		seven	= 7
four times			

4. Which kind of transport do you usually use when you have luggage?

KBS -	= 1	Motor-bike	j _ 5
Matatu		Bicycle	
Company car	= 3	Walking	
Private car	= 4		

5. How much does one-way trip cost?

Ksh

1 - 2

3 - 5



6 - 10



10 - 15



16 - 20



20+



Don't know

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Q U E S T I O N N A I R E - K B S (PERSONNEL)

(a) When did the KBS start operating in Nairobi?

Year:

(b) How many buses were in operation at the start and how many are in operation now?

No. of Buses: At start Now_

(c) Is there any difference between the buses used then and those used now?

Yes/No.

If so, what is the difference?

(d) What has been the yearly increase in the number of buses over the years?

Year	Buses
------	-------

(e) What is the average number of passengers per bus now?

(f) What has been the yearly increase in the number of passengers over the years?

Year	<u>Passengers</u>
------	-------------------

(g) How many routes in all are served by the city bus service?

Number of routes:

(h) What factors determined the choice of routes?

Factors:

(i) What is the maximum distance served from the city centre to the periphery within the city council boundaries?

Maximum distance:

(j) What determines this maximum distance?

Factor:

(k) How many trips does a bus make on the average?

Number of trips:

(l) Are the specific routes used by the city buses different from those used by other passenger traffic?

Yes/No.

If so, why?

(m) What are some of the reasons why some of your buses have started operating outside the city council boundaries?

Reasons

(n) How adequate are your services to the general public?

Very adequate Adequate Not adequate

(o) Services provided by matatus are important to some city residents: Do you think these services are competitive, complementary or supplementary to your services?

(p) The escalating cost of oil has been marched by high bus fares:

What effects has this had on your services to the public?

Effects:

(q) What are the lowest and highest fares charged by your company?

Lowest Kshs. Highest Kshs

Do these compare well with the fares charged by other passengers services within the city?

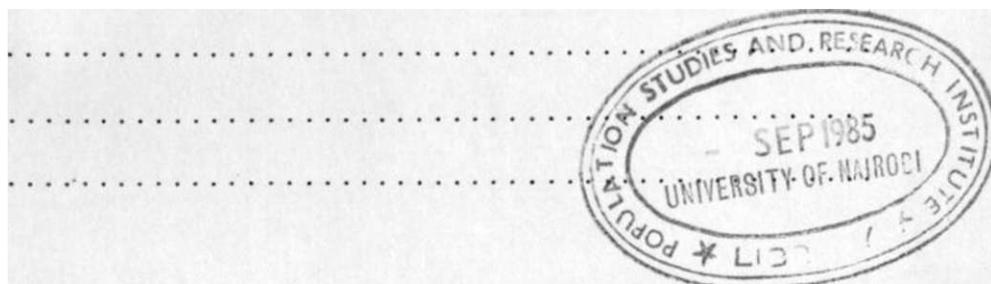
Yes/No.

(r) When and What nature of fare increases have you had?

Ypnr Increment (Ksh)

(s) What are the main problems encountered by your company in providing services to the public in Nairobi?

Problems:



(t) What are some of the possible solutions to these problems?

Solutions:

(u) What are the future prospects of the KBS Ltd. Co. in terms of coping with the demand for public transportation in Nairobi?

Future prospects:

(v) How many buses operate in the following wards?

<u>Ward</u>	<u>Buses</u>
Kibera	
Eastleigh	
Kariobangi	
Dandora	
Nairobi South & West	
Umoja	
Parklands	
Lavington	
Karen	

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Q U E S T I O N N A I R E - MATATUS (ASSOCIATION
PERSONNEL)

(a) When was the matatu association formed?

Year

(h) What are some of the objectives of the association?

Objectives:

(c) How far are these objectives being fulfilled?

(d) How many matatus registered with the association when it started?

Number:

(e) How many has the association registered now?

Number:

(f) What has been the annual increase in the number of matatus over the years?

Year

Number of Matatus

(g) Howmany matatus do you think are not registered?

Number: _

(h) Are all the association matattis licensed to carry passengers?

Yes/No.

(i) Do the matatus charge the same fares per stage as the KBS?

Yes/No.

(j) How far from the city centre do the matatus carry passengers?

Distance (km)

(k) Do they compete with the KBS for passengers?

Yes/No.

(l) Why do you think some passengers prefer matatus service to the KBS?

Reasons:

(m) What is the average number of passengers per matatu per trip?

Number of passengers:

(n) Roughly how many trips does each matatus make a day?

Number of trips:

(o) What are some of the problems matatus experience in their operation?

Problems:

(p) How could these problems be solved

Solutions:

What do you think of the future of matatus in terms of their **provision of** public transportation services to the general public?

5. What reasons made you start operating matatu?

Make a living = 1

Boost Income = 2

Other Specify = 3

6 Do you think that KBS is a threat to matatu operations?

Yes - X Don't know = 3

No = 2

7. Do you think that matatus are a threat to the KBS?

Yes - 1 Don't know = 3

No = 2

8. Why do you think that some people prefer using matatus to KBS?

Faster = 1 Extra facilities |__| = 4

Cheaper |__| = 2 Other Specify - = 5

Stop anywhere |__| = 3

9. What is the minimum fare charged by your matatu?

Ksh 1.00 Q - 1 2.00 U = 3

. 1.50 Q - 2 2.50 Q - 4

10. What is the maximum fare charged by your matatu?

Ksh 1.50 Q = 1 3.50 Q - 5

2.00 Q = 2 4.00 [] = 6

2.50 Q = 3 4.50 Q = 7

3.00 Q = 4

11 Do you support the Government's idea of having a standard matatu? i 1

Yes ' ' = -1¹ Doesn't matter I 1 = 3

No ● = 2

12 What problems do you mainly encounter in your operations?

Police harrassment • -

High policy premiums = 2

Other , Specify = 3

13. What suggestions would you make to solve these problems?

Acceptance and respect for matatus = 1

Lower the premiums = 2

Other , Specify = 3

14. (a) Do you think that both KBS and matatus are adequate for the users' requirements?

Yes = 1 Don't know = 3

No = 2

(b) If no, do you think they will be adequate in the near future?

Yes = 1 Don't know = 3

'No = 2

(c) If no, what do you suggest could be done to provide adequate services?

Mass transit = 1

Government competitor to KBS = 2

Other 1 I , Specify = 3

15. Do you agree with the opinion that matatus:.

Over-load?	Yes	●	●
		●	W
	No	●	—
	Partly		
Overspeed?	Yes	●	—
		●	—
	No	●	—
	Partly		

and/or overtake/obstruct other road users unnecessarily?

Yes ● = 1

No **EH** = 2

Partly = 3

16. If yes or partly to any of the above, what do you think should be done to curb these problems?

Standardise matatus ● =

Re-organise matatu control | j = 2

Other , Specify _____ = 3