AN ANALYSIS OF FACTORS INFLUENCING CHOICE OF 14-SEATER PUBLIC SERVICE VEHICLES AND ALTERNATIVE MODES OF PUBLIC SERVICE TRANSPORT IN NAIROBI CITY

BY

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DECLARATION AND APPROVAL

I declare that this research project report is my own original work and has not been presented for award of any degree in this or any other university.

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ABSTRACT

In the year 2010, the Kenya government announced that 14-seater vans, commonly referred to as "*matatus*", were to be phased out so as to reduce traffic congestion on the roads and also to ensure efficient commuter movement. Travelers on Kenyan roads have not experienced public transport system without 14-seater PSVs. It is not known whether the perception of commuters about the efficiency of 14-seater vehicles in the city of Nairobi is higher than for the alternative PSV modes. The study's general objective was to establish factors that determine the commuters' choice of 14-seater PSVs over the other alternative PSV modes in Nairobi city in terms of travel time, fare charged, distance walked, number of alternative routes and time taken to board a vehicle to full capacity. Survey research design was used. The population was low-cadre employees who commute and work at the headquarters of government ministries in Nairobi. Random sampling method is used to select the ministries. Departments in the ministries were also identified through random sampling. Desired data was collected through the administration of a questionnaire whose validity and reliability was ascertained using a pilot study in Nakuru town. The data was processed and analyzed using χ^2-test, analysis of variance, linear regression model with respect to time and fare charged. The insights gained in the research are of great importance to policy makers in government and non-governmental agencies dealing with public passenger transport. The study established that travel time from house to workplace had influence on choice of 14-seater PSV over the other alternative PSV modes. Second, the existence of alternative routes had influence on commuter choice of 14-seater PSV over the other alternative PSV modes. Third, fare charged had effect on commuter choice of 14-seater PSV over the other alternative PSV modes. Fourth, the fare charges during the off-peak hours influenced the commuters' choice of the PSV vehicle they would wish to use. Fifth, the time taken to walk by a commuter had no influence on choice of 14-seater PSV over the other alternative PSV modes. To phase out 14-seater PSVs, the government can introduce operational regulations on the use of 14-seater PSVs that make the said PSVs unattractive to both investors and commuters.

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LIST OF ABBREVIATIONS AND ACRONYMS

BRT - Bus Rapid Transit

BST – Bus Semi-transit

FHWA - Federal Highway Administration

HCM - Highway Capacity Manual

HICs – Highly Industrialized Countries

INFORMS – Institute for Operations Research and Management Sciences

IPTS – Institute for Prospective Technological Studies

KBS – Kenya Bus Service

LMICs – Low and Medium Industrialized Countries

PSV – Public Service Vehicle

ROW –Right of Way

SACCOs – Savings and Credit Co-operative Societies

UNECA - United Nations Economic Commission for Africa

USA – United States of America

VII – Vehicle Infrastructure Integration

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Public transport is as old as the existence of mankind. People looked for modes of transport that suited their needs. In the past, carts pulled by horses or donkeys or camels were in use. When fuel powered engines were invented they became a better alternative since they were fast and they could carry a larger number of passengers (http://www.click4wdmail.com, 2013).

Nairobi was originally the site of a water hole called *Enkare Narobi*, which means cold water in Maasai language. It became a railroad centre in the early 1900s. When Kenya attained independence from the British in 1963, the area of Nairobi was expanded from 91 square kilometres to 689 square kilometres (World Book, Inc., 2001).

Nairobi is the capital city of Kenya and the city's central business district has many modern buildings. It serves as the commercial hub as well as the country's administrative headquarters. The transport sector is served by road, rail and air. Many of Nairobi's people live in large, low-cost apartment complexes called estates. Other residents occupy single-family homes (Ibid).

Motorized public service transport in Kenya dates back to the day when the first motor vehicle was used to ferry passengers for a fee from one point to another. At first, the business of transporting people commercially was a preserve of buses owned either by individuals or by passenger transport companies. *Matatu* is "a crowded taxi" (World Book, Inc., 2001).

Use of "crowded taxis" in Kenya started in the 1950s (Graeff, 2009). Those who used the "crowded taxis" at that time say that the owners of station wagon type of the Ford model cars individually started ferrying passengers from Nairobi's City centre to Lungalunga residential estate also in Nairobi at a fee of three ten cents coins. Due to the thirty cents fare charged, Kikuyu speaking people coined the phrase *"mang otore matatu"* meaning "thirty cents", was used in reference to the vehicles offering public passenger service to an extent that land public passenger transport vehicles were named *matatus* (Chitere and Kibua, 2004). From then on, other models of vehicles joined the business with Nissan becoming the ultimate choice for the job. In some cases the Toyota models were in use but the general populace kept and still keeps referring

to them as Nissan *matatu* (www.matatu.co.ke). A majority of Kenyans use public passenger service vehicles to commute to and from their respective workplaces and for intra-city or inter-town travel. An ever increasing population used the service so much so that there was an increase in the number of the 14-seater PSVs. Indeed www.matatu.co.ke provides an estimate of over 80,000 PSV vehicles in Kenya and 85% of these are 14-seater PSVs operating in the urban and rural areas. The Matatu Welfare Association further estimates that there are 15,000 matatus on about 50 routes in Nairobi, and about 80 per cent of them – 12,000 – are the 14-seaters (Kenya Confidential, 2010).

14-seater PSVs operated illegally in Kenya until 1973 when then President Jomo Kenyatta issued a decree officially recognizing matatus as a legal mode of public transport. The decree allowed matatus to operate without obtaining any form of licensing (Mutongi, 2006). The public passenger transport service grew by leaps to such an extent that regulations governing operations in the industry were not followed and even seemed non-existent. The industry was so chaotic that when the National Rainbow Coalition government took the reigns of power from Kenya African National Union in January 2003, the Minister appointed to serve in the Transport docket brought to prominence the rules that ought to have governed the sector but had not been enforced by the previous holders of the office. Legal Notice 161, which is commonly referred to as the Michuki Rules, after then Transport Minister Michuki, was adopted in 2004 (Graeff, 2009). He went further to introduce others which were meant to ensure that the sector operated in tandem with the current needs of passengers. They included the requirements that all PSVs must be fitted with a first aid kit, a speed governor and safety belts for each passenger, drivers and their assistants wore uniforms that clearly distinguished their roles and each PSV had to have a yellow line drawn on its sides.

Since then, subsequent Legal notices; 165 of 2005, 118 of 2007 and 173 of 2009 tried to introduce changes that could significantly alter the management practices in the sector (www.kenyalaw.org, 2011). Some of the floated proposals for inclusion in the industry's activities included: the need for each PSV to have a waste bin, the requirement that individual PSV owners should register with SACCOs, or join a company, and; that 14-seater PSVs were to be phased out while retaining those with higher passenger capacity to continue with the business (Ibid). The implementation of the later policy proposal was scheduled to kick off in Nairobi in

January, 2011 (Matatu Welfare Associatioin, 2010). The policy was to be rolled out to other parts of the country at a later date. This announcement was followed by the rider that vehicles of a higher passenger capacity would continue to be in business and that anyone interested in the business was advised to acquire mini-buses and/or buses.

The directive was greeted with instant rejection from players in the industry with many of them basing their reasoning on issues such as the unrealistically short time between the announcement and the implementation date. One such complaint came from Matatu Welfare Association who argued that the three-year period they were required to comply with the Bus Rapid Transit Program was insufficient, loss of jobs for many youth and the risk of wastage of investments that were yet to break-even (Ibid). These sentiments indicate that players in the public passenger transport had accepted the proposal save for the consequences of implementation in the short term.

The reasons given by 14-seater PSV operators for rejecting the proposed policy change are diametrically opposite to the scenario envisaged by the policy makers at the Ministry of Transport. The Ministry's idea of policy change to the proposed phasing out of 14-seater PSVs was driven by the need to decongest vehicular traffic in the city of Nairobi hence reduced motor vehicle accidents (G.o.K, 2010). It was also in the opinion of the policy makers in government that the use of vehicles with higher passenger capacity in transporting people would greatly increase the rate at which commuters would move in and out of the city.

The rationale behind the plan to phase out the 14-seater PSVs as offered by the Ministry of Transport technocrats was that the targeted PSVs contributed to the problem of chronic traffic jam experienced by motorists in Nairobi. They also argued that the PSVs with higher capacities would move a higher number of commuters at a time compared to the 14-seaters hence an improved efficiency in both vehicular and passenger traffic. Furthermore, road safety would improve while the cost of transportation is expected to reduce (G.o.K, 2010).

The arguments floated by the government and implementers in the parent Ministry on the phasing out of the 14-seater PSVs were propositions that were made without the backing of empirically tested data that capture the perceptions of commuters. Graeff (2009) stated that it was and still is problematic that there is no consistent data available regarding PSVs. Indeed, it is

this state of affairs, particularly, the missing views of consumers of the service that need to be investigated.

The study intends to empirically enlighten on the consequences of the intended plan of action targeting 14-seater PSVs. This was possible through the carrying out of research to ascertain whether or not the phasing out of the said PSVs would lead to a more efficient public passenger transport system. The findings of the research will also provide a clue on the means by which commuters will travel in the absence of the 14-seater PSVs. Otherwise, the government would implement the policy without the support of system-specific empirical data thereby consigning themselves and people dependent on public transport to a wide field of possibilities which might turn out to be either positive or negative.

1.2 Statement of the Problem

The overriding concern of every stakeholder in the transport industry is the need to have an efficient public transport system. Indeed, such a system should move a high number of commuters, decongest traffic, take less time for a commuter to travel from departure point to destination and enable people to travel at an affordable price. Commuters' perception of a mode of transport dictates their demand for it and thus their preference. In the event that 14-seater PSVs are phased out, commuters may have a preference for other modes of transport other than the bus as suggested by policy makers in government. These other modes include motorized two-wheelers, three-wheelers (tuk-tuk) and four-seater taxi. This was likely to make the management of vehicular and human traffic more complex hence new problems in the industry. It was not known whether the perception of commuters about the efficiency of 14-seater vehicles in the city of Nairobi is higher than for the alternative PSV modes and hence the possibility of the policy not being effective in increasing efficiency in the PSV transport industry. What was the likelihood that passengers perceived 14-seater PSVs as a better mode of transport due to its capacity and consequently time taken or convenience when travelling? Similarly, in the absence of 14-seater PSVs, what was the likelihood that passengers would opt for vehicles whose capacity is less than 14? Phasing out 14-seater PSVs might therefore not solve the problem of traffic congestion. This study sought to investigate whether the implementation of the policy would lead to improved efficiency of vehicular and passenger traffic. It is on the afore-stated account that the study sought to find out if the phasing out of the 14-seater PSVs from the roads

in the city of Nairobi would be a solution to the dual problems of traffic congestion and a slower rate of commuter movement.

1.3 Objectives of the Study

1.3.1 General Objective

The study's general objective was to establish factors that determine commuters' choice of 14-seater PSVs over the other alternative PSV modes in Nairobi city.

1.3.2 Specific Objectives

The research was undertaken based on the specific objectives listed hereunder.

i. To determine if time taken to travel from house to pick-up point influences the choice of 14-seater PSVs over the other alternative PSV modes.

ii. To establish the extent to which the number of alternative routes influences the choice of 14-seater PSV over the other alternative PSV modes.

iii. To establish the extent to which fare charged affects the choice 14-seater PSV over the other alternative PSV modes.

iv. To investigate the influence of time taken to walk from drop-off point to the workplace by a commuter on his/her choice of 14-seater PSV over the other alternative PSV modes.

v. To investigate the influence of time taken to board a PSV to full capacity on a commuter's choice of 14-seater PSV over the other alternative PSV modes.

1.4 Research Hypotheses

The following hypotheses were tested.

H_1: Travel time from house to pick-up point has no influence on choice of 14-seater PSV over the other alternative PSV modes.

H_2: The existence of alternative routes has no influence on commuter choice of 14-seater PSV over the other alternative PSV modes.

H_3: Fare charged has no effect on commuter choice of 14-seater PSV over the other alternative PSV modes.

H_4: The time taken to walk by a commuter from drop-off point to the workplace has no influence on choice of 14-seater PSV over the other alternative PSV modes.

H_5: Time taken to board a PSV to full capacity has no influence on the choice of 14-seater PSV over the other alternative PSV modes.

1.5 Justification

Experimentation of new ideas in the actual management of public affairs can be a sure recipe for disorder in the society. Studies have been done on urban traffic management but were not adequately addressing the commuters' preferences. There was a likelihood that in the absence of 14-seater PSVs commuters may prefer using two-wheelers or tricycles thereby causing more traffic congestion. This study was intended to scientifically establish whether the presence of the 14-seater PSVs on Nairobi city roads has an influence on commuter traffic. The findings of the study would provide insights on the factors influencing choice of 14-seater public service vehicles and alternative modes of public service transport.

1.6 Significance of the Study

The research findings would greatly help policy makers and other stakeholders in understanding a priori the consequences of the changes identified for implementation in the passenger transport sector. Knowledge gained from the research would be a useful tool in making decisions concerning the suitability of the use of 14-seater PSVs or other alternative motorized modes or a mixture of the two in the transportation of passengers in Nairobi City and later on, in other major towns in Kenya. Findings of this research work would form part of the basis for further research.

1.7 Assumptions of the Study

In this study, it was assumed that all the vehicles studied carried their full passenger capacity; commuters used all motorized modes of transport when travelling into and out of the City centre; the vehicles ferried passengers from the city's residential estates to the city centre and back; all PSVs were licensed and that drivers were consistent and/or homogeneous. Units of a given mode of transport are also assumed to be homogeneous.

1.8 Scope of the Study

The data that was used in the study was collected from low-cadre government employees, who commute using PSVs and work at the headquarters of ministries in the city of Nairobi between May, 2012 and June, 2012.

1.9 Limitations of the Study

At the time of data collection, the government had stopped licensing new 14-seater PSVs. The effect of the action might have affected the results.

To address the limitation above, the collection of data was conducted before 14-seater PSVs were completely phased out from Nairobi CBD.

1.10 Definition of Terms

Articulated bus – It refers to a vehicle with the main body on two axles and an articulated section with the third axle. These buses are 16-18 m long and have a capacity approximately 50 percent greater than regular bus, that is, 60-120 passengers.

Bus Rapid Transit (BRT) – This is a popular but incorrect name for Bus Semi-rapid Transit (BST). BST is a bus system operating mostly on Right-of-Way status. The status represents transit ways that are partially separated from other traffic. It operates with preferential road signals, separate stations with fare collection prior to boarding, regular or articulated buses and other amenities.

Bus Rapid Transit Programme – It refers to transit modes which have right of way (ROW) on their entire routes, which is never the case with buses in Kenya where the roads are used by mixed traffic.

Bus stop - It refers to a designated passenger pick-up or drop-off point on the side of a road.

Central Business District – This refers to the geographical area of Nairobi covering the city centre and Upper Hill/Community.

Commuter preference - This refers to the mode of public passenger travel that is liked by a high number of commuters.

Consistent driver - A consistent driver is one who is expected to behave the same way every time at all similar situations. He or she is not expected to reject a gap and then subsequently accept a smaller gap.

Critical gap – Refers to a minimum length time interval that allows intersection entry to one minor street vehicle.

Efficiency – It refers to the extent to which a vehicle's capacity as an input can meet the travel demand of people in a transportation system, that is, the fastest, low cost and hence preferred mode of transport. It is also used to denote a mode of transport that takes a relatively short time span to move passengers from one point to another. It also refers to a convenient means of transport which consequently ferries a large number of passengers over a given period of time. Lu H. and H. Yuan (2003) define efficiency as the relationship between the input of an urban transportation system and its capability of satisfying the transportation demand in the system.

Gap - The time interval between passage of one vehicle and the arrival of the next vehicle. In strict technicality, the gap is measured from the back bumper of the front vehicle to the front bumper of the next vehicle.

Homogeneous drivers- all drivers are expected to behave in exactly the same way.

Low-cadre employees – Employees of the Government of Kenya earning less than thirty thousand shillings per month in salary.

Matatu – Refers to a means of public passenger transport vehicle which ferries passengers who randomly board it at the bus stops on the route it operates. The passengers disembark at their various destinations after paying a fee to the conductor. Such vehicles are of different passenger capacities ranging from 7 – 26-seater PSV.

Minibus – A minibus is a 6-8 meters long vehicle, which has a capacity of 15-40 seats (Vuchic, 1999). It is used for lightly traveled lines.

Mode of transport-This refers to the capacity of vehicle used by commuters. They are in six categories namely; one passenger motorized two-wheelers,2-3 motorized three-wheelers,4-7-seater taxis, 8-14 seaters,14-seater, 15-32-seaters and 33-seater and above.

Para-transit – It is the process of being moved or carried from one part of a country or town or city to another. Graeff (2009) captured its definition as "a service that is not quite full public transit and that has some of the convenience features of private automobile operations. It is often smaller in scale than public transit systems, utilizing smaller vehicles, and it can be legal or illegal as defined by local rules and regulations"

Passenger – A passenger is a person who is travelling in a car, 14-seater vehicle, a minibus or a bus and who is not driving it or working in it.

PSVs – This refers to public passenger vehicles which are licensed to carry pay-to-board passengers on Kenya's roads. They carry a minimum of one passenger.

Public passenger vehicle – This is a vehicle owned and run by an individual or a company and is boarded by anyone who travels over a given distance of road. Those boarding it pay fare at a rate determined by the operator. The fare charged is commensurate to the distance travelled by the passenger.

Public transport - (also public transportation, public transit, or mass transit) is a shared passenger transportation service which is available for use by the general public, as distinct from modes such as Taxicab and car pooling which are not shared by strangers without private arrangement.

Regular bus or simply bus is 10-12 m long, 2.50 m wide. It has 30-60 seats (Vuchic, 1999).

Road intersection – This is a point where a road meets another and they either cross each other (that is, four roads meet) or one road comes to a dead end in which case it becomes a T-junction or one road merges with another, say, a minor road joining a major road at an angle such that traffic flow as though they were all moving in the major road.

Saloon car – It refers to a vehicle whose passenger capacity is less than seven.

Vehicle – It refers to motorized two-wheeler, three-wheeler, four-wheeler, six-wheeler and 10-wheelers.

14-Seater PSV - This refers to a public passenger service vehicle that is licensed by the government of Kenya to carry a maximum of 14 passengers.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This study mainly concerns efficiency in traffic flow. The literature reviewed mainly focus on traffic flow, efficiency in transport and consumer perception in public passenger transport. Traffic flow theories seek to describe in a precise mathematical way the interactions between vehicles and their operators (the *mobile* components) and the infrastructure (the *immobile* component). The latter consists of the highway system and all its operational elements which include control devices, signage and markings among others (INFORMS, 2002). The former considers factors such as the quality of the driver's attention, the driver's judgment of information and the characteristics of the driver's reaction (Zhang *et al*, 2007).

2.1 History of Traffic flow theory

The beginning of motorized transportation by road started at the turn of the 19th century and was used primarily for circulating postal mail and transporting goods. Over time, advancement in roadways which involved progressing roads from dirt and gravel to pavement created a surge of passenger travel (Oster *et al*, 2011).

The scientific study of traffic flow had its beginnings in the 1930's with the application of probability theory to the description of road traffic and the pioneering studies conducted by Greenshields at the Yale Bureau of Highway Traffic; the study of models relating volume and speed and the investigation of performance of traffic at intersections (FHWA, 2002).

After World-War II, there was an increase in use of automobiles and the highway system was also expanded to serve the motorists. There was also a surge in the study of traffic characteristics and the development of traffic flow theories. The 1950's saw theoretical developments based on a variety of approaches, such as car-following, traffic wave theory (hydrodynamic analogy) and queuing theory (Rathi, 2002).

Newell (2002) avers that various literatures on traffic flow theory were formulated in the 1950s and 1960s. He also noted that there is very little useful literature in the 1970s, 1980s, or early 1990s. He further states that there has been a revival of interest in traffic flow theory in the late

1990s, mostly because vehicle detectors have been installed at many highway locations throughout the world to record the passing of vehicles. This, however, does not hold true for Kenya at the moment.

All traffic flow theories are unanimous on most of the factors to be considered when tackling problems associated with traffic movement. Traffic theory has many dimensions and the traffic flow factors being investigated determines the theory to be used. The basic and common factors include traffic flow q, traffic density E and speed s.

2.2 Traffic flow theory

To understand the consequences of any traffic management strategy, one must have some theories or models that can be used to determine how traffic will respond to various actions the strategy involves. As stated earlier in the introduction of this research work, commuters in Kenya have always had a mixed passenger transport system. However, the government is in the process of phasing out the 14-seater PSVs and this will create a transport system that is either more efficient or inefficient. In an attempt to explain the likely scenario in the event the strategy is fully implemented, the study makes use of gap acceptance theory which is applicable to traffic flow at an intersection.

Unsignalized intersections give no positive indication or control to the driver. The driver alone must decide when it is safe to enter and when to leave the intersection. The driver looks for a safe opportunity or "gap" in the traffic to enter the intersection. This technique has been described as gap acceptance (FHWA, 2002). At unsignalized intersections a driver must allow the passage of vehicles that have priority over his/her attempt to enter the traffic stream and thus the driver must yield to these drivers.

FHWA (2002) states that it is useful to consider the gap acceptance process as one that has two basic elements. They are: the extent drivers find the gaps or opportunities of a particular size useful when attempting to enter the intersection and the manner in which gaps of a particular size are made available to the driver. Consequently, the proportion of gaps of a particular size that are offered to the entering driver and the pattern of the inter-arrival times are important.

2.3 Gap Acceptance Theory

The gap acceptance theory commonly used in the analysis of unsignalized intersections is based on the concept of defining the extent drivers was able to utilize a gap of particular size or duration (FHWA, 2002). For instance, will drivers be able to leave the stop line at a minor road if the time between successive vehicles from the left (or right) is 20 seconds; and, perhaps how many drivers was able to depart in this 20 second interval?

The minimum gap that all drivers in the minor stream are assumed to accept at all similar locations is the critical gap. The assumption is that no driver will enter the intersection unless the gap between vehicles in a higher priority stream is at least equal to the critical gap, *tc*. For example, if the critical gap was 6 seconds, a driver would require a 6 second gap between vehicles in priority stream before departing. He or she will require the same 6 seconds at all other times he or she approaches the same intersection. Analogously, all other drivers will utilize the same critical gap duration at that intersection.

Troutbeck and Brilon (2002) postulate that within gap acceptance theory it is assumed that a number of drivers was able to enter the intersection from a minor road in very long gaps. Usually, the minor stream vehicles (those yielding right of way) enter in the long gaps at headways often referred to as the "follow-up time", *t f*.

Troutbeck and Brilon (2002) further argue that it has been found that the gap acceptance parameters *tc* and *t f* may be affected by the speed of the major stream traffic. It is also expected that drivers are influenced by the difficulty of the maneuver. The more difficult a maneuver is the longer are the critical gap and follow-up time parameters.

2.4 Public Passenger Transport in Global North and Global South

Őrn (2005) stated that the institutional structure of urban public transport systems in the Global North and Global South typically differ along two axes:-market structure and system organization. This line of argument was picked up by other scholars. Alexander *et al* (2007) stated that systems in the Global North were characterized by monopolistic operations, publicly regulated fare structures and clearly delineated, fixed and coordinated route systems regardless of whether they were based on bus service, light rail or metro service. In the Global South on the other hand, there tend to be a wide range of variations on systems that border between para-

transit and semi-fixed route operation. These include minibuses, three-wheeled vehicles, and motorized and non-motorized rickshaws. They further argue that the market structure is typically characterized by low barriers to market entry when no effective legal or extra-legal impediments are set in place for potential service suppliers and hence results in a highly competitive system in which individual owner-drivers compete with one another along a mix of uncoordinated and informally designated routes. Although owner-drivers were the norm, small fleets of vehicles in which a single owner supplied vehicles to several drivers in something akin to fleet operation was also common.

According to Belwal and Belwal (2010) many countries in the Middle East have turned their attention towards developing and improving their public transport systems, as problems such as traffic congestions in cities, low mobility, high individual costs of transport, and a rural-urban divide in services have arisen. The objectives of the study were; to assess the needs and perceptions of people towards the establishment of an effective public transportation system in Oman and to study resident characteristics such as usage behavior, experience, sharing habits, and other behavioral aspects about public transportation in Oman. Their study titled Public Transportation Services in Oman: A Study of Public Perceptions found that public transport services in Oman are minimal and do not match demand, and there is an excessive reliance on private cars which are costly to maintain. They observed that public transport services have not met its purpose despite its existence for a significant period in Oman. People prefer to travel by their own cars and are sufficiently convinced of the merit of this mode of travel even if the price of oil doubles in Oman. They continued to argue that in order to offer any solution; the needs and expectations of the people have foremost to be taken into account (Ibid).

In Ikorodu, Lagos, Nigeria, Agunloye (2011) did an analysis of the travels of public transport passengers (road). His variables were: time spent per daily trip, trip distance of respondents; purpose of the respondents' trip; waiting time of passengers; travel times per week; unexpected breakdown of vehicles; fuelling difficulties in a month; occurrence of minor accidents in a month; long journey time and frequent stops. He concluded in his study that there was need for a special planning by the transport planners for the travel distance and passengers' waiting time, as they were revealed to be the major contributors to passengers' travel demands. The paper gave a policy suggestion that additional cabs were required in order to eliminate passengers'

unnecessary wait time in the study area. He further stated that there was need for government policy statement on public transportation that addresses passengers' travel demands that encompass passengers' travel-friendly rules for an efficient system.

Friman and Fellesson (2009) in their study opined that understanding—rather than taking for granted—the links between satisfaction and an objective service supply is a key management challenge that requires a genuine understanding of how the transport system functions, from the point of view of both the customer and production. Such a dual understanding will provide an indispensible foundation for developing the public transport systems of tomorrow. Once the subjective and partly independent nature of the satisfaction measures is acknowledged, their potential value to managers and policymakers can be realized. They further noted that satisfaction is pivotal for understanding public transport from the customer's perspective. A high level of satisfaction does not necessarily indicate an objectively "better" system and vice versa. The study sought to analyze the relationship between the objective performance measures of public transport services and the satisfaction perceived by travelers.

El-Geneidy *et al* (2009) in their study titled Bus Transit Service Planning and Operations in a Competitive Environment and whose variables were: run time; length of segment; number of traffic signals, stop signs and bus stops located on the analysis segment; and route - observed that a reliable service to a passenger is the service that can be easily accessed at origin and destination, arrives on time, has a short travel time/run time (similar or better than private vehicle travel time), and has low variance in travel time and a short waiting time. They concluded that personal vehicles have an inherent travel time advantage over buses under existing conditions. To ensure the competitiveness of BRT, freeway-like conditions set under bus-only shoulder policies would increase the amenity value of the BRT and attract ridership (Ibid).

Sclar (2008) argued that planning means the conscious attempt, by state actors, to rationally control the size, shape and growth rate of city-regions via the exercise of state power over infrastructure placement, public transport service supply and land use control. This formulation of the role of the state in the planning process was derived directly from the planning experience that evolved over the course of the 19th and 20th centuries in the industrializing cities of the HICs of Europe and North America. Basing his research on land use and transportation situation,

Sclar (2008) further argued that attempts to transplant this planning methodology with its implicit assumptions about the role and competency of the state (often proved wrong even in the HICs themselves) to the rapidly urbanizing city-regions of former colonies in sub-Saharan Africa and South East Asia in the early 21st century were proving to be illusive and frustrating. Going by the afore-stated, it is imperative to devise approaches to urban transport planning rooted in the experience of the LMICs as they are, and not of the HICs as they were or hope to be.

It was however noted that there were other authors whose views on public passenger transport were divergent from those mentioned above. One such author is Vuchic (1999) who in his paper Urban Public Transportation Systems argued that in developing countries, transit had an even more important role than in industrialized countries because its economic efficiency was vital for large volumes of non-car owners, while its capacity was needed to serve the high-density, rapidly growing cities. The subject of discussion was the same but the discussants differed considerably on the way forward concerning the appropriate system of public passenger transport in LMICs. Kenya is classified under the LMICs.

It is necessary to mention here that in the United States of America, it has been noted that longer and heavier trucks tend to disrupt traffic flow on roadways more than conventional vehicles. However, more trucks of any size or weight would also disrupt traffic. Disruption occurs in the through traffic lanes, at roadway intersections (FHWA-Office of Policy, 1999).

It is worth noting that some countries have tried to develop their own solutions to the public transport problems that they experience. A case in point is Malaysia. In a presentation titled GTP Roadmap: Improving Urban Public Transport (2009), Dato Sri Ong Tee Keat, Minister of Transport in the government of Malaysia says "Our historical approach to urban transport has been to try to build our way out of congestion, relying on more roads and more cars as a solution to increasing demand for travel. Mature cities cannot escape the problem of congestion by simply building more roads. We need to shift from emphasizing the efficient and cost-effective movement of vehicles to the movement of people."

The suggestion put forward by the policy makers in Malaysia makes sense except that it is short on giving direction on specific course(s) of action that needs to be taken in order to attain desired level of efficiency and effectiveness in the management of passenger and vehicular movement.

Public passenger transport in Kenya is currently of the mixed traffic type. It is noted in the reviewed literature that the opinion held by FHWA-Office of Policy, 1999 concurred with what Vuchic (1999) stated concerning mixed traffic.

In mixed traffic, the speed and reliability of bus service depend on traffic conditions. Their average speed is lower than average speed of cars because they stop to pick up and drop off passengers. Buses are therefore not very competitive with car travel in the same corridor with respect to speed and reliability (Vuchic, 1999).

2.5 Road Passenger Transport in Nairobi

In Nairobi, control of physical transport technologies is split between the public sector and the private sector. The public sector supplies the transport infrastructure, through the Ministry of Roads and Public Works and the Nairobi City Council. The private sector supplies the bulk of the transport services through fixed-route services provided by City Hoppa, a private bus operator, and a vast fleet of privately owned mini-buses (Howe and Bryceson, 2000). The findings of Howe and Bryceson were in a study they did in Nairobi on Poverty and Urban Transport in East Africa: Review of research and Dutch donor experience.

Residents of Nairobi face the inconvenience of daily commute to work, making traffic congestion the most widely experienced social problem. On weekdays, commuters driving to and from work experience inevitable delay as huge numbers of drivers navigate the roads in a relatively small time frame (Kornhauser, 2007).

The likelihood of a slow ride to the city centre is very common for commuters in Nairobi. As a rapidly growing city, many of the commuters working or seeking services in the city centre live in the wider suburban area. This is due to the observation that Nairobi residents have increasingly sought to escape the city for the greener suburbs or that the cost of housing is lower in the suburban estates (Ibid). Unfortunately, this decision by so many working people in Nairobi costs a fortune not only in commuting costs, but more importantly in wasted time. Kornhauser (2007) did his study on Traffic Congestion: How Predictable? Discovering Volume Trends across Time and Confirming Fundamental Speed-Flow-Density Relations with his major concern being Traffic Volume and the variables were: weather, incidents, special events, construction and time.

The commuters use various modes of transport as they access their respective destinations in the city. While a majority of the low income earners walk or ride bicycles to work irrespective of the location of their residences, the bulk of the commuters use 14-seater PSVs, buses or saloon cars. Howe and Bryceson (2000) observed that the 14-seaters, 26-seater, 30-seaters, 42-seaters and buses are run by entrepreneurs who avail their vehicles on the road and charge commuters fare for using them.

There is also a quasi publicly provided public transport service: the Kenya Bus Company. It was noted that as a result of both a shortage of public subsidy and a turn away from the popularity of direct public service among development policy makers, the service level of the Kenya Bus Company has fallen drastically (World Bank and UNECA, 1994). G.o.K. (2010) stated that the fall of Kenya Bus Company created a vacuum and City Hoppa and the other PSVs have stepped in to address the transport need. This has resulted in the tremendous growth of the PSV industry, to both positive and negative effects. Making an effective planning framework operational is difficult because the public and private actors involved in transport are so numerous (Ibid).

Once the largest bus company in Kenya, Kenya Bus Services (KBS), ran into financial difficulties, forcing them to reduce the number of buses operated. They are currently operating minibuses within Nairobi city, although new, smaller, city buses offering passengers higher standards of comfort and safety have been introduced on some inner-city routes (www.transport.go.ke, 2010)

Nairobi's para-transit consists of privately owned *matatus*, mostly operating on the same routes as KBS, but without timetables. *Matatus* had formal route associations such as Eastleigh's route 9, Buruburu's routes 23 and 58, Langata's route 15 among others but they were at one time banned for political reasons (World Bank and UNECA, 1994). They, however, existed informally until the year 2004 when they were re-formalized through Legal Notice 161(www.transport.go.ke, 2010).

KBS estimated the number of *matatus* operating in Nairobi at 6,500, out of which 2,500 were 25-seaters and 4,000 were 12-seaters (World Bank and UNECA, 1994). Nairobi continued to depend on *matatus* to transport people to and from various destinations located in the metropolitan area and as a result their numbers increased from 400 in 1973 to an estimated

15,000 *matatus* in the Nairobi Metropolitan Area (Graeff, March 2009). Matatu Welfare Association (2010) puts the number of 14-seater PSVs operating in Nairobi at 12,000 whereas the total number of vehicles is 500,000 a day.

The Matatu Welfare Association estimates that there are 15,000 matatus on about 50 routes in Nairobi, and about 80 per cent of them – 12,000 – are the 14-seaters (Kenya Confidential, 2010). Overall, there are about 80,000 registered Public Service Vehicles in Kenya, with 60 percent of these – 48,000 – operating in urban centres (Ibid).

The World Bank and UNECA (1994) estimated that the *matatu* sub-system at that time captured some 70% of the public transport market, or 700,000 passengers per day. This market share was estimated at some 50% in 1993/94, and had continued to grow substantially over the years.

In theory, there is some government control of PSVs operations. Transport Licensing Board regulations were introduced in 1999 requiring PSVs operators to state and remain on the routes for which they were licensed, but it has not been possible to enforce this effectively. This state of affairs continued to be witnessed even after the implementation of Legal Notice 161 in the year 2004 (Mutongi, 2006).

According to Graeff (2009), PSVs largely ignored official bus stops and, especially in peak hours, they departed only when fully occupied, and generally drove non-stop to the final destination. In off-peak periods, drivers tried to pick-up as many passengers as possible on the way, which led to erratic driving and stopping behavior. She states that during congested periods, traffic rules were often ignored by actions such as using the road shoulders to by-pass traffic jams. The World Bank and UNECA (1994) noted that bus and vehicles of all other capacities shared the regularly congested carriageway with other road users. Dedicated infrastructure such as bus lanes as well as preferential treatment at controlled intersections was absent. The most interesting feature about the system is that competition takes place on the same routes, in a deregulated environment, between two very different sub-systems. KBS operates on the time-tabled sub-system while the PSVs owned by individuals or SACCOs had no time-tables guiding their operations.

2.6 Theoretical Studies

Queuing theory is almost exclusively used to describe traffic behavior at signalized and similarly at unsignalized intersections. Queues occur whenever instantaneous demand exceeds the capacity to provide a service thus the theory involves the mathematical study of the waiting lines formation. The parameters used in this theory are traffic flow q, traffic density E and speed s, that is, $q = E * s$ (Woensel, 2000). The method is easy to use in computation provided that data is available. However the model has limitations if used in this study.

In this study, the two critical gap parameters that need to be estimated are the critical gap, *tc,* and the follow-up time, t *f.* The technique used to estimate these parameters fit into a regression analysis of the number of drivers that accept a gap against the gap size (Troutbeck and Brilon, 2002).

Data availability makes it possible for the problem at hand to be analyzed and conclusions drawn. In the critical gap technique, the queue must have at least one vehicle in it over the observation period. The process involves the following steps: record the size of each gap, t, and the number of vehicles, n, that enter during this gap; for each of the gaps that are accepted by only n drivers, the average gap size, $E(t)$ is calculated. For lack of precision tools that measure the distance between vehicles following one another and also the time it takes a vehicle on a minor road to completely merge with the vehicular traffic in the major road, whoever is interested in using this approach would most probably take interest in the number of unit vehicles of target modes of transport, that is, saloon cars, 14-seater PSVs, mini-buses and buses. This would then lead to the working out of the mean number for saloon cars, 14-seater PSVs, mini-buses and buses so as to obtain the $E(t)$ for each mode of transport; linear regression is used on the average gap size values (as the dependent variable) against the number of vehicles that enter during this average gap size, n; and finally, given the slope is t_f and the intercept of the gap size axis is t_o , then the critical gap t_c is given by $tc = to + tf/2$ where t_c is the critical gap time, t_f is the "follow-up time" and t_0 is intercept of the gap size.

It is necessary to point out that the system of public transportation determines the efficiency of moving people from departure point to their respective destinations. In this paper, efficiency in public passenger transportation is defined as: the extent to which a vehicle's capacity as an input

can meet the travel demand of people in a transportation system hence commuters' choice of that mode of transport.

2.7 Efficiency

According to Yuan and Lu (2003) the definition of efficiency is the relationship between input and output or between costs and benefits in a certain system. They further stated that in economics, the general meaning of efficiency is the extent to which a certain amount of productive resources can meet the demand of human beings. They also argued that given the same amount of input, (read infrastructure and modes of transport), different efficiency will conduce to quite different output.

A transportation input such as the construction of transportation facilities cannot increase within a short period of time, but the demand of transportation is growing rapidly. In this regard, the Kenya government intends to phase out 14-seater PSVs as a way of decongesting traffic in the existing infrastructure. Yuan and Lu (2003) say that improvement of the efficiency of urban transportation systems is the best way to effectively utilize the existing inputs which mainly include roads, enhancement of the capacity of systems and relieve urban traffic congestion and that factors influencing urban transportation efficiency such as the effects of urban land-use pattern and transportation structure are chronic and long term, while those of urban transportation infrastructure and traffic management systems are obvious and short term.

The evaluation of transportation systems garners significant attention in the planning, engineering, policy, management, and economics. Measures of effectiveness (MOE) include assessments of the efficiency of the system. Each profession approaches the problem differently, with unique concerns and objectives. Engineers perceive efficiency as mobility and safety, economists view it as utility whereas managers see it as productivity and planners view it as accessibility (Levinson, 2004). His study on Perspectives on efficiency in transportation was conducted in The United States of America. While each field adopts what it feels is appropriate, the perceptions of transportation users, that is, the consumer is of paramount importance.

In Ireland, for example, households with income greater than $75,000 drive less miles since they prefer air travel for long distances whereas households with income below $25,000 have a greater reliance on trips by bus than by, say, rail or air. Nearly four percent of long distance trips

are made by bus in this income range, compared to only two percent of households in the higher income bracket using bus (Oster *et al*, 2011).

While this lower income bracket is a larger consumer of bus trips than other household incomes, 80 percent of these households still own at least one car. Even households without a car are still twice as likely to travel by personal vehicle, either borrowing a car or carpooling, because personal transportation is more efficient than public transportation in many cases (Ibid).

In addition to the efficiency aims noted above as well as perceptions on efficiency, the political system is also concerned with fairness and justice, which are very difficult to define, while striving to guarantee that public facilities are adequate or that an overall level of service standard is met (Levinson, 2004). The professions mentioned above generally take the ''objective'' viewpoint of the government planner, who may in fact be an engineer, manager, or economist rather than the ''subjective'' perspective of the travel consumer.

The transport sector is an important component of any economy because it impacts on the development and welfare of the people. When transport system is efficient, it provides economic and social opportunities such as market accessibility and increased investments which consequently bring about the growth of any given economy. In Kenya, for example, the PSV transport sector contributes 25% of the GDP (Matatu Welfare Association, 2010). It is not known if the sector's contribution to the economy is as a result of efficiency in its operations or not.

Song *et al*, (2011) in their work opined that when commuters are choosing a transport service, importance is ranked as follows: on time departure, transport company system of accountability, charge, proximity of office or house at the destination, and transport time. A majority of research ranked the order as time, cost, convenience, consumer impressions of the Transport Company, and productivity (Ibid).

Despite the undeniable beneficial impacts of transportation networks on our lives, there are numerous factors by which they impair our everyday life. Without doubt, many of us have experienced being trapped in heavy traffic, wasting our time and energy resources (Nekoui and Pishro-Nik, 2009). The two had studied The Effect of VII Market Penetration on Safety and Efficiency of Transportation Networks in the United States of America based on: clustering

configuration and inter-vehicular gaps and perception-reaction times for different classes of vehicles.

2.8 Commuter perception in public passenger transport

In their paper titled User satisfaction with para-transit in competition with motorization in Indonesia: anticipation of future implications where they sought to establish important factors and attributes explaining user perceptions and priorities regarding the service, Joewono and Kubota (2007) stated 12-14-seater PSVs is an efficient road user in Bandung, Indonesia, contributing only 18% of traffic flow while being able to transport more than 50% of passenger trips. However, they create congestion, as the units stop for access and egress anywhere, wait for passengers, and make circular movements in dense areas.

Performance is one important aspect influencing the future of public transport modes. In that connection, useful analysis needs to be done so as to determine whether urban transit operators are working in technically efficient ways (Ibid). In addition to concerns for the profitability and sustainability of transport services, national authorities should also consider such outcomes as mobility, accessibility, and environmental impact, as well as how the urban population perceives the outcomes of public policies and measures (Ibid). Information gathered from the public is important in evaluating public transport, as the exclusion of customers from improvement efforts to date has created difficulties (Ibid).

The measurement of public perceptions of urban transport performance and policy can reveal problems and priorities the public perceives broadly, and is necessary for assessing the quality of policies and what urban populations actually perceive the problems, priorities, and issues to be (Ibid).

Fitzpatrick Associates (2004) did a study in Ireland. The areas of interest in the study were: choice of service; frequency of service; pricing; information, advice and support; safeguard and redress; and other relevant consumer issues. It was noted that when considering passenger transport (infrastructure and services) from a consumer perspective, it is important to recognize that it has a distinct nature and context that makes it different from most other infrastructure or services used by the consumer in Ireland. There are a number of important points to note in this respect. First, transport as an "Enabler": Passenger transport is not only a service that the

consumer buys or uses, but also an enabler that allows the consumer to access other goods and services. For example, most consumers who wish to buy goods at major retail centres need transport, whether by private car or by some other form, in order to get them to where they want to shop. Not only does transport give access to goods and services, however, but it also allows people to do many other things that are essential to day-to-day life – getting to/from work, getting to/from hospitals or medical facilities, attending recreational and leisure events and activities etc. Transport is therefore something that affects virtually everybody in society and which has an important bearing on every person's quality of life.

Secondly, transport serves different needs: transport is probably unusual compared to most consumer goods and services in that there are many different types of transport service with many different types of uses. Levels of usage for passenger transport, for example, vary depending on the mode involved and the purpose for which the consumer uses each.

Thirdly, transport coverage varies: the scope of transport infrastructure and services in Ireland varies, but especially depending on the type of transport involved. For example, Ireland's relatively low population density and its spatially dispersed population (in both urban and rural areas) has major implications for public transport service provision in Ireland – this means, for example, that not all parts of the country can support high frequency bus and rail services and that the private car is the dominant form of transport in most areas. It also means that there are actual and potential bus and rail connections that may be noncommercial but socially desirable (Fitzpatrick Associates, 2004). The State both as a regulator and a provider of infrastructure and services significantly influences the nature of the passenger transport sector (Ibid).

While there is no comprehensive data available on patronage for either private bus services or taxi/hackney services in Ireland, increases in fleet size would suggest that their use has expanded. The number of small public service vehicles in operation (including taxis and hackneys) has grown by 52% between 1999 and 2003, while the number of large public service vehicles in operation has grown by 13% in the same period (Ibid).

In consumer-oriented criteria, the overall rating of different types of transport/service is viewed according to, in order of priority, choice of provider; choice of routes; service frequency; price

competition; pricing options; availability of information and advice; access to safeguards and redress (Fitzpatrick Associates, 2004).

2.9 The Theory of Consumer Choice and Consumer Choice Model

Evidence on mode choice for the journey to and from work among a cross-section of workers in the formal sector of Accra (Ghana) suggests that travel-to-work behaviour of employees in the sector is influenced mainly by perceived service quality of the commercial commuter vehicles as well as employees' personal circumstances rather than by conventional transport characteristics such as access, waiting or in-vehicle times (Abane, 2002). Gender roles, age differences, disposable incomes relative to travel costs as well as the reliability of schedules by the individual modes are the most important factors workers take into consideration in choosing their modes (Ibid).

Individuals attach value to savings in travel time hence behavioural models of travelers' modal choice have been built on the theory of consumer choice (Hensher, 1976). Given a sample of travelers who are assumed each to have alternative methods of transport to choose from, one of which is his actual method for the journey and the others are alternatives which he may or may not have used on any previous occasion, the theory reveals that the acceptance of one means of transport and the rejection of the others is an indication of preference (Ibid). The choice of mode is related to a few of the characteristics of the available modes of transport. The characteristics include perceived efficiency of the mode as viewed by the traveler (Ibid).

A point of potential substitution in choice begins when an individual considers the relative advantages of alternative modal options. If one had his usually chosen mode and he is faced with alternative modes of transport, the individual will enter his decision space and commences a search and learning procedure in order to decide whether to maintain his habitual mode or select an alternative mode. The decisions are based on the underlying attitudes of individuals towards modal characteristics such as price, time, comfort, etc. In so doing, an individual gains knowledge on the level of the combination of relevant characteristics that places him/her in a position where he/she can trade –off alternative combinations of quantities of the given set of characteristics and hence modal options (Ibid).

To illustrate the statement above, two quantitative measures that influence choice of mode were taken, namely; cost and time. The value of travel time savings is an attitudinal concept drawn from consumer choice theory. In this case, an individual the amount of cost change that would have to occur in his/her usual mode of journey in order for him or her to consider an alternative mode of transport (Ibid).

Hensher (1976) studied the value of commuter travel time savings in the Transport Studies Unit, University of Oxford and Commuter Bureau of Roads in Australia. He found that if the potential transfer price is expressed in terms of a money outlay rather than time outlay, a model consistent to this situation would be:-

$C = a_o + a_1x_1 + a_2x_2 + \ldots + a_nx_n$

where C= the net monetary benefit of mode of choice, equal to Cu – Ca + TPc;

Cu→ usual cost

Ca → alternative cost

TPc is the transfer price

x_1= the reported time difference between the usual and the alternative modes and $x_2,\ldots,x_n$= all other variables which are measurable as significant contributions to the perceived net benefit of the chosen mode.

2.10 Utility Function

According to Domencich and McFadden (1996), a theory of individual travel demand is derived from the theory of consumer choice behavior in relation to transportation demand decisions. Related to this is the theory of rational choice behavior which asserts that a decision maker can rank possible alternatives in order of preference, and will always choose from available alternatives the option which he considers most desirable, given his tastes and the relevant constraints placed on his decision-making such as his level of income, time availability or perceived efficiency (Ibid).

The consumer is assumed to have a utility function defined on both consumption and transportation attributes. The range of transport related decisions made by the consumer include the locations of residence and job, frequency of work trips, destination of trips, time of day of travel and mode of travel (Ibid).

Court-Griliches-Becker-Lancaster model assumes that the consumer has a series of basic wants and he is assumed to have a utility function defined for levels of satisfaction of these wants which brings about his sense of well-being (Ibid).

If a consumer has reasonable preferences about consumption in different circumstances, then, a utility function is used to describe his/her preferences (Bergstrom, 2010). How a person values consumption in one state as compared to another depends on the probability that the state in question will actually occur and how likely the states shall be. In this case, utility depends on the probabilities as well as the consumption levels.

An example of a utility function involving two states that might be used to examine choice under uncertainty is the Cobb-Douglas utility function stated as:

$u(c_1,c_2,\pi,1-\pi) = c_1^{\ \pi} c_2^{1-\pi}$ (Ibid).

This function originates from two mutually exclusive states such that if one of them happens, say, π_1, the other, $\pi_2 = 1 - \pi_1$. c_1 and c_2 are the consumptions in the two respective states. The expected value under this scenario is: $u(c_1,c_2, \pi_1, \pi_2) = \pi_1 c_1 + \pi_2 c_2$ (Ibid).

A convenient form that the utility function above can take is $u(c_1,c_2, \pi_1, \pi_2) = \pi_1 v(c_1) + \pi_2 v(c_2)$. That is, the utility is written as a weighted sum of some function of consumption in each state, $v(c_1)$ and $v(c_2)$ where the weights are given the probabilities π_1 and π_2 (Ibid).

2.11 Conceptual Framework

The dependent and independent variables in this study are based on the relationship between choice of mode of transport and the mode's efficiency as perceived by the commuter; the main concern being fast traffic movement and low price hence preferred mode of transport.

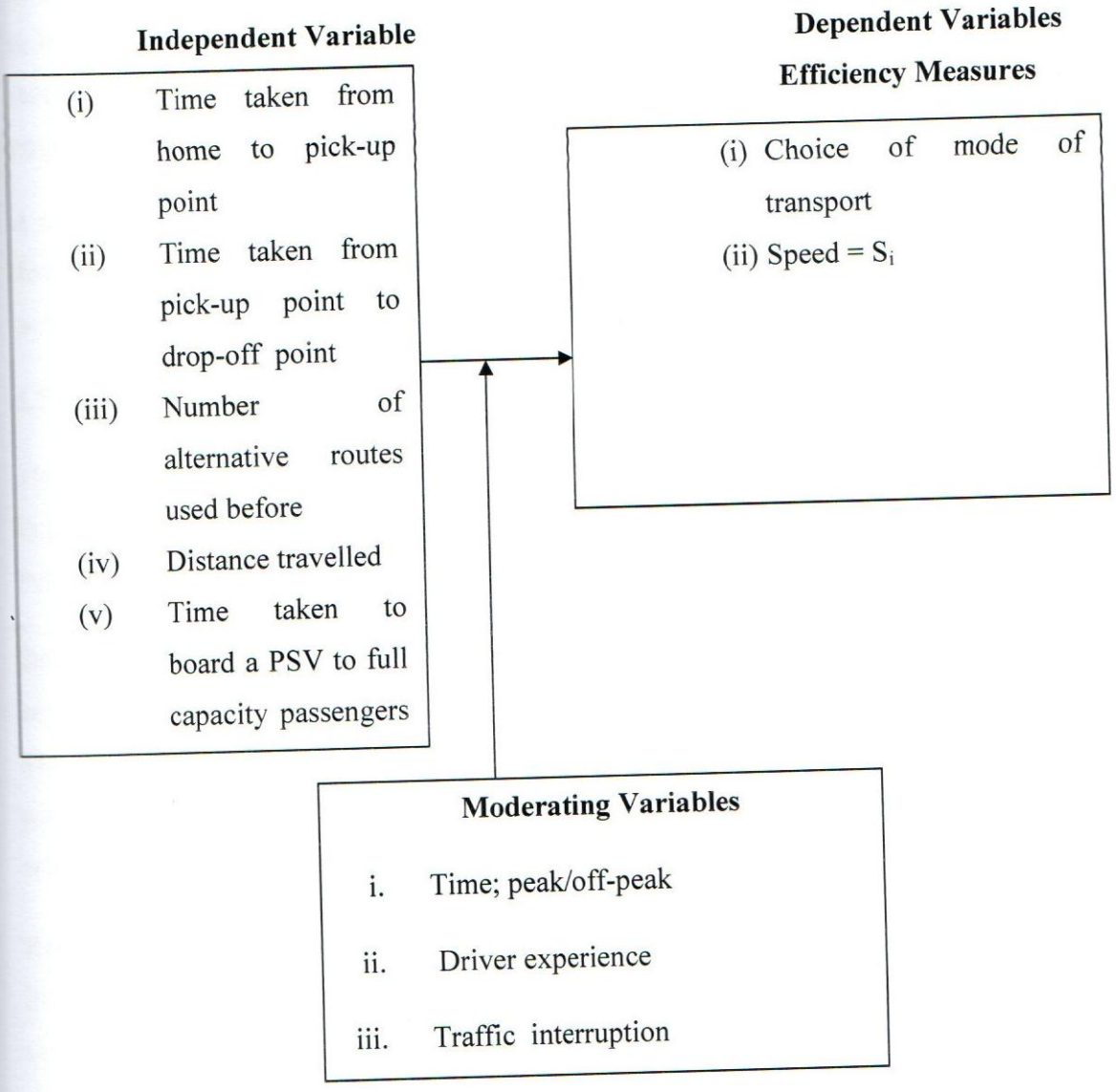

Figure 1: Conceptual Framework. Source: Own, 2011

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Research Design

In a bid to bring about insights and a better understanding of the contribution of 14-seater PSVs to PSV commuters in government institutions within Nairobi's central business district, a survey research design under descriptive design was used. Questionnaires were given to some employees of the sampled ministries.

A survey was used since the answers given by respondents to questions asked about a situation describe the respondents' perception of the situation. Reality is what the respondents generally perceive it to be.

3.2 Research Area

The study was carried out in Nairobi City, Kenya, since it was the town earmarked for initial implementation of the phase out of 14-seater PSVs. Nairobi was also considered due the high number of motor vehicles providing passenger transport service in the city.

Data on every road in Nairobi needed not be taken since the information on travel experience on any road in the city could be obtained by interviewing the commuters who use the said roads. The key concern of the study was the efficiency of road passenger travel from a passenger's perspective. The study made use of incisive questions targeting efficiency to an extent that there was no need to literally take measurements at intersections or bus stops.

Roads in the City Council of Nairobi allow mixed passenger transport to operate and the road infrastructure has busy intersections and bus stops - an attribute which lacks in most other major towns in Kenya.

3.3 Study Population

Vehicular and passenger traffic in the city of Nairobi operate twenty-four hours a day. There are times when both types of traffic are heavy. Such times commonly referred to as peak time occur in the morning hours of 6.30a.m to 9.00a.m and in the afternoon between 3.30p.m and 7.00 p.m. Conversely, off-peak time referred to the duration when the roads are with light traffic. This

situation obtains between 9.30a.m and 3.00p.m during day time and as from 7.00p.m in the evening till 6.30a.m of the following day.

All the roads used by commuters in Nairobi city made up the desired location. Target population comprised government low-cadre employees working at the ministries' headquarters in Nairobi. This ensured homogeneity of the respondents. The PSVs formed the unit of observation whereas government low-cadre employees (commuters) were the unit of enumeration.

3.4 Sample Size

Employees in government offices within the central business district of Nairobi including Upper Hill/Community area and who used public passenger transport to commute were targeted as respondents to a questionnaire that was used in this study.

In social science research, where there is no estimate available of the proportion of the target population assumed to have the same characteristics of interest, the following formula can be used to determine the sample size (Mugenda and Mugenda, 1999).

$$n=\frac{Z^2pq}{d^2}$$

Where

n = the desired sample size

Z = the standard normal deviate at the required confidence level

p = the proportion in the target population estimated to have characteristics being measured

q = 1 – p

d = the level of statistical significance test

If there is no estimate available of the proportion of the target population assumed to have the characteristics of interest, 50% should be used (Ibid).

Going by the afore-stated, the study used p = 0.50. In that case the Z-statistic was 1.96. The desired level of accuracy in this study was 0.05. The formula shown above, for determining

sample size was therefore used to obtain the sample size that was accessed. That is:

$$n=\frac{Z^2pq}{d^2}$$

$$n = \frac{(1.96)^2(0.50)(0.50)}{0.05^2}$$

$$n = 384$$

It is from the calculation above that the study targeted a sample of 384 low-cadre government of Kenya employees working at the headquarters of Ministries in Nairobi's central business district.

3.5 Sampling Technique

Random sampling was used to pick out respondents from the sampling frame of the study. Sampling frame constituted the headquarters of government ministries located within Nairobi's central business district. The Kenya government had 42 ministries (http://www.communications.go.ke, 2008). A third of the ministries provided sufficient number of respondents in the study. The ministries were listed alphabetically. Random sampling was used to select the first ministry to be visited. Systematic sampling where two ministries were skipped was then used to identify subsequent ministries until 14 of them were selected. Thirty respondents per ministry were selected randomly. This way, the sample size of 384 respondents was attained.

Once the government ministries had been identified, random sampling was again used to identify departments where respondents worked in. The respondents from each department were selected randomly. Questionnaires were given to low-cadre employees working at the headquarters of government ministries located within Nairobi's central business district. This was informed by the fact that the identified persons used roads which experienced mixed traffic in Nairobi city while at the same time the roads were the backbone of public passenger transport for vehicles operating within the city. Furthermore government offices had a large number of employees who commuted by public transport for lack of staff buses or self- driven private cars. They also spent their weekdays commuting to and from the workplace. Specifically targeted were lower cadre employees who (i) are not entitled to an official car and (ii) earn salaries which do not permit them to own and maintain own car.

3.6 Research Instruments and Data Collection Procedure

A questionnaire was given to low-cadre employees working at the headquarters of government ministries located within Nairobi's central business district. A questionnaire was chosen since the respondents were commuters who worked in offices because they were literate and could therefore read, comprehend and write. They therefore could provide information wherefrom data on perception of commuters towards modes of PSV transport could be gleaned. Respondents with a low understanding of the English language were assisted by an enumerator.

A senior cadre employee in the selected ministries was requested to distribute the questionnaires and collect responses. The questionnaire contained questions which elicit responses on the fare commuters paid, the number of vehicles they boarded and the estimated time they took to travel from home to their workplaces. Other variables of interest were: time taken by a commuter to walk from his/her house to the point of boarding a PSV; time taken to walk from the last PSV drop-off point to the workplace; the number of alternative routes the commuter had used in the past while en route to the workplace; and lastly the time taken to board a PSV to full capacity at the first departure point.

3.7 Validity and Reliability of Research Instrument

Validity refers the extent to which a research instrument measures what it is designed to measure whereas reliability refers to the degree of consistency of a research instrument to produce the same results when used by someone else (Kenya Institute of Management, 2009).

Prior to the actual data collection in the research area, a pilot study was conducted in Nakuru town, Kenya where a Cronbach's alpha (KR20) value of 0.76 was attained. Based on data from the pilot study, the reliability of the research instrument was ascertained.

The research instrument obeys construct validity. Internal consistency method of attaining reliability was achieved through the use of Cronbach's alpha (KR20) whose reliability coefficient is computed using the formula below.

$$\alpha = KR20 = \frac{k\left(S^2 - \sum s^2\right)}{S^2\,(k-1)}$$

Where k = number of items in the instrument

S^2 = variance of all scores

s^2 = variance of individual items

3.8 Data Analysis

Data collected from respondents was summarized and coded into various themes and clusters according to the responses given by the respondents.
Thereafter, the coded data was analyzed using Chi-square (χ^2) test, classical and linear regression models and analysis of variance (ANOVA) with the help of Statistical Package for Social Scientists (SPSS). The analyzed data was presented by use of tables, bar charts and pie charts.

In the regression model, D is the ratio of frequency of 14-seater use over total frequency for all PSV modes of transport.

The regression models are $M= f(F,Tv,T_{w1},T_{w2},Cn,Alt,T_F)$ (Equation 1)

$S = t(F,Tv,T_{w1},T_{w2},Cn,Alt,T_F)$ (Equation 2)

$D = d(F,Tv,T_{w1},T_{w2},Cn,Alt,T_F)$ (Equation 3)

Where

M = Frequency of use of 14-seater mode per month

$i = i^{th}$ respondent

F = Fare charged

D = Distance travelled for fare charged

Tv = Time taken travelling in the PSV boarded

T_{w1}= Time taken to walk from house to PSV boarding place

T_{w2}= Time taken to walk from the last stage to workplace

Cn = the number of vehicles boarded from house to workplace

Alt = the number of alternative routes used by the PSV in the past

T_F = Time taken to board a PSV to full capacity at the boarding place

$$S_i = \frac{DISTi}{Ti}$$

$DIST_i$ = Distance from home to workplace in kilometers

T_i = Total time taken from home to workplace by given mode ($Tv + T_{w1} + T_{w2} + T_F$)

M_i and D_i represent preference of mode

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter covers the data analysis of efficiency of 14-seater public service vehicles and alternative modes of public service transport in Nairobi city. The chapter contains; Respondents' demographic characteristics, the relationship between the time taken to travel from house to workplace and the choice of 14-seater PSVs over the other alternative PSV modes, the extent to which the number of alternative routes influences the choice of 14-seater PSV over the other alternative PSV modes, the extent to which fare charged affects the choice 14-seater PSV over the other alternative PSV modes; the influence of time taken to walk by a commuter on his/her choice of 14-seater PSV over the other alternative PSV modes and the influence of time taken to board a PSV to full capacity on a commuter's choice of 14-seater PSV over the other alternative PSV modes.

The questionnaire gave respondents six modes of PSV transport choices. They were: 1-passenger two-wheeler, 2-3 wheeler three-passenger, 4-7-seater taxi, 14-seater, 22-32-seater and 33 seats and above seater. Almost all respondents did not provide information on 1-passenger two-wheeler, 2-3 wheeler three-passenger and 4-7-seater taxi. This in turn meant that the later three modes of PSV transport were considered in the analysis stage of the study and the former three were ignored.

4.2 Respondents Demographic Characteristics

The study considered the following respondents' demographic characteristics; gender, age bracket, the period of stay in Nairobi, the ministry where they work, the route they use from their residence to their workplace, number of years they have been commuting and time taken from their residence to work place.

Table 4.1: Respondents' Gender, Age and Operation Route

Variable	Data Value	Frequency	Percent
Gender			
	Male	256	74.2
	Female	86	24.8
Age			
	18-25 years	128	37.1
	26-30 years	48	13.9
	31-35 years	103	29.9
	36-40 years	28	8.1
	41-45 years	24	7
	Over 50 years	14	4.1
Route			
	Ngong Road	105	30.4
	Thika Road	69	20
	Mombasa Road	29	8.4
	Waiyaki Way	39	11.3
	Muthurwa Area	75	21.7
	Valley Road	28	8.1

Source: Field Data (2012)

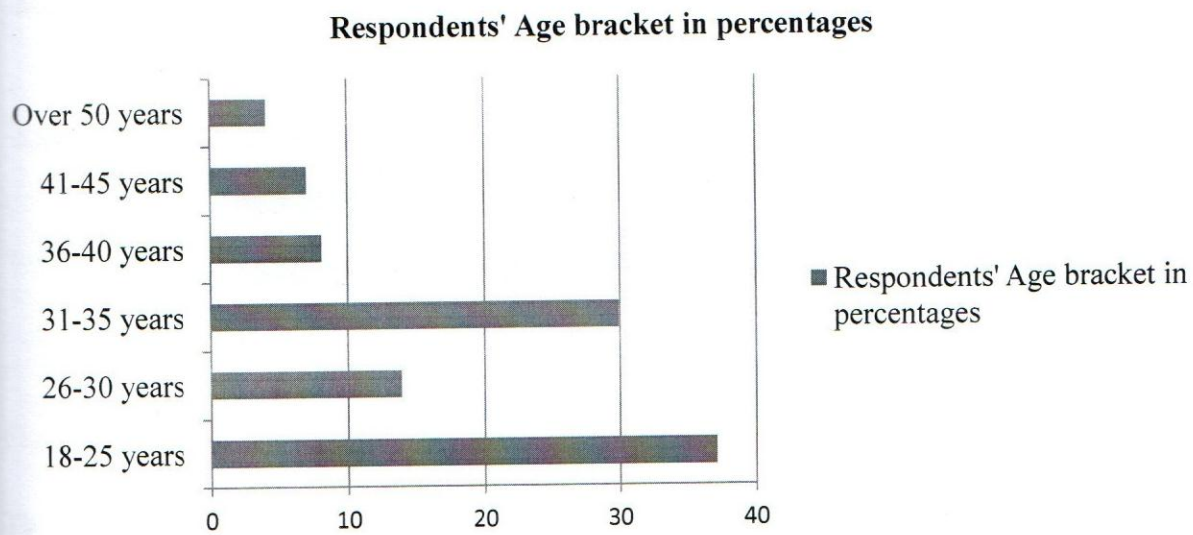

Figure 2: Respondents' Age bracket in percentages. Source, Field Data (2012)

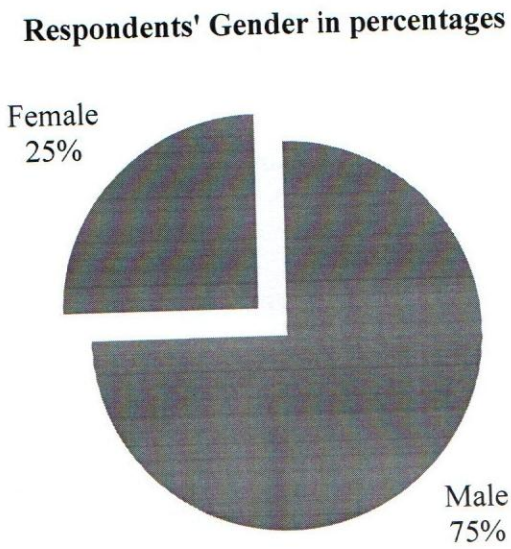

Figure 3: Respondents' Gender in percentages. Source, Field Data (2012)

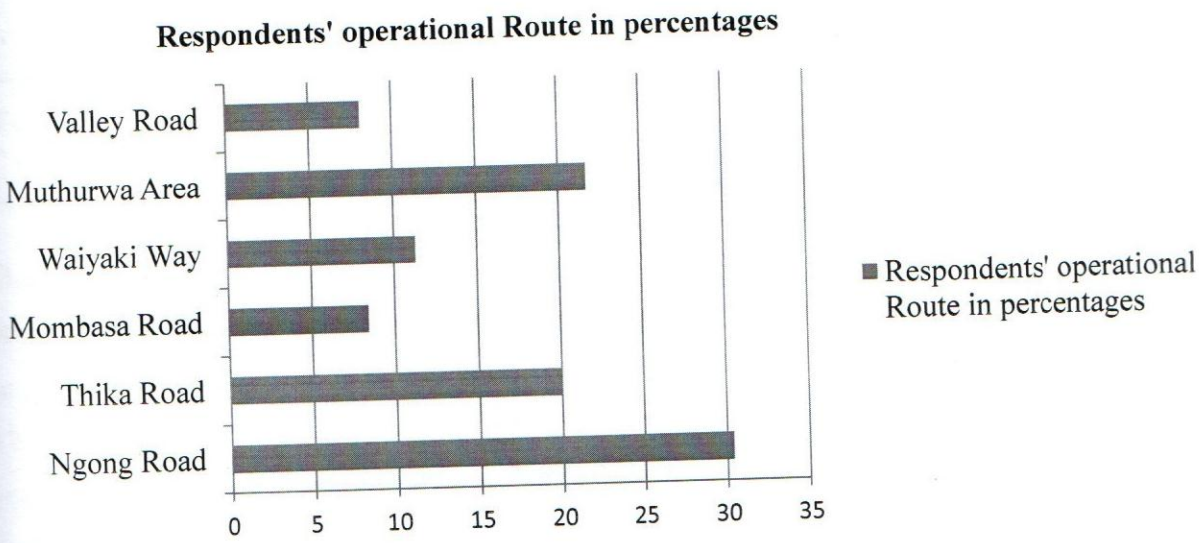

Figure 4: Respondents' operational Route in percentages. Source, Field Data (2012)

The study established that the majority of the respondents 75.2% were male compared to 24.8% who were female. This finding showed a serious skew of the male gender that was overwhelmingly more in number than the female. There is a need to implement the spirit and letter of the newly enacted constitution which advocates for gender balance in the civil service.

51.0% of the respondents were within 18-30 years age bracket, 38.0% were 31-40 years age bracket, 15.1% were within 36-50 years and 4.1% were over 50 years of age. This finding showed that the civil service had energetic workforce which will take a long period of time before their retirement age. This is a good age balance at work place practice which can enhance service delivery in the civil service.

A majority of the respondents, 30.4%, use Ngong Road, 21.7% use Muthurwa area and the surrounding roads, 20.0% use Thika Road, 11.3% use Waiyaki Way, 8.4% use Mombasa Road and 8.1% use Valley Road. This finding directly corresponded to the population distribution in Nairobi City. The majority of the population stays in Eastlands, Kibera and Kawangware. Residents of the later two places pass through Ngong Road when travelling to and from the city centre.

Table 4.2: Period of Residence and Commuting, Time from House to Workplace Descriptive Statistics

Variable	No.	Min	Max	Mean	Std. dev.
Period of residency	345	1	30	11.5	8.5
Period of Commuting	345	1	30	5.9	5
Time taken from house to work place	345	1	90	39	20.5

Source: Field Data (2012)

The study established that the least a person resided in Nairobi was for a period of 1 year and the person who had stayed for the longest period of time had stayed for 30 years. Averagely, the respondents had stayed for a period of 11.5 (mean) years with a standard deviation of 8.5 years. This finding indicated that the respondents had stayed in Nairobi long enough (average of 11.5 years) to have an experience on how the public service vehicles operate making them in position to give a fair view on efficiency of 14-seater public service vehicles and alternative modes of public service transport in Nairobi city.

It was also established that the least a person has been commuting in Nairobi is a period of 1 year and the person who commuted for the longest period of time had commuted for 30 years. Averagely, the respondents had commuted for a period of 5.5 (mean) years with a standard deviation of 5.0 years. This finding indicated that the respondents had commuted in Nairobi fairly long enough (average of 5.9 years) to have an experience on how the public service

vehicles operate making them in position to give a fair view on efficiency of 14-seater public service vehicles and alternative modes of public service transport in Nairobi city.

The least time a person took to travel from the house to work place was 4 minutes and the person who took the longest period of time to travel from the house to work place took 90 minutes. Averagely, the respondents travelled for a period of 39 minutes (mean) with a standard deviation of 20.5 minutes.

4.3 Time and the choice of 14-seater PSVs over the other alternative PSV modes

The first objective of the study was to determine if time taken to travel from house to workplace influences the choice of 14-seater PSVs over the other alternative PSV modes.

Table 4.3: Distance Covered and Time Taken from the House to Pick-up Point

Variable	Data Value	No.	Min	Max	Mean	Std. dev.
Distance from house to pick-up						
	14-seater	345	100	1000	422	274.2
	22-32 seater	345	100	1000	390	231.2
	33 and above seater	345	100	1000	421	272.5
Time from house to pick-up						
	14-seater	345	5	45	11.54	8.49
	22-23-seater	345	5	45	10.96	8.64
	33 and above seater	345	5	45	11.65	8.64

Source: Field Data (2012)

The study established that the shortest distance covered by the respondents from house to pick-up point was 100 metres whereas the longest was 1000 metres. It was found out that the respondents covered the shortest distance 390 metres from their houses to the stage where they picked 22-32-seater PSV, for 14-seater and 33 and above seater, they covered 422 and 421 metres respectively. This finding showed that although the 22-32-seater PSV were most accessible to the commuters compared to 14 and 33 and above seaters in terms of distance covered, there was no significant difference in the distance covered by the commuters to the pick-up place.

It was established that the shortest time taken by the respondents from house to pick-up point was 5 minutes whereas the longest was 45 minutes. The respondents took the shortest time of 10.96 minutes from their houses to the stage where they picked 22-32-seater PSV whereas for 14-seater and 33 and above seater, they took 11.5 and 11.65 minutes respectively. This finding showed that the 22-32-seater PSV were most accessible to the commuters compared to 14 and 33 and above seaters in terms of time it took them from their houses to the pick-up points.

Table 4.4: Correlation Coefficient between choice of 14-Seater and Alternative PSV in terms of Time Taken

PSV Mode	Correlation Coefficient (p-value)	t-Value
22-32-seater	0.649 (0.00)	26.2
33 and above seater	0.352 (0.01)	14.2

Source: Field Data (2012)

The dependent variable was 14-Seater PSV whereas the independent variable was 22-32-seater PSV and 33 and above seater PSV. The study established a correlation of 64.9% between 14-seater PSV and 22-32-seater PSV compared to 35.2% correlation between 14-seater PSV and 33 and above-seater PSV. The hypothesis that travel time from house to workplace has no influence on choice of 14-seater PSV over the other alternative PSV modes was accepted since there was a strong correlation between time taken from house to pick-up point of 14-seater PSV and 22-32-seater PSV. This showed that the preference for a 14-seater is not related to the time they take from their houses to the PSV pick-up points.

4.4 Alternative routes influences on the choice of 14-seater PSV over the other alternative PSV modes

The second objective of the study was to establish the extent to which the number of alternative routes influences the choice of 14-seater PSV over the other alternative PSV modes.

Table 4.5: 14, 22-32, 33 and above seater ability to make use of Alternative Routes

Variable	Data Value	Frequency	Percent
14-Seater			
	Very Quick	146	42.3
	Quick	76	22
	Average	123	35.7
22-32 seater			
	Very Quick	28	8.1
	Quick	271	78.6
	Average	15	4.3
	Slow	31	9
33 and above seater			
	Quick	55	15.9
	Average	80	23.2
	Slow	210	60.9

Source: Field Data (2012)

It was established that the majority of the respondents 64.3% observed that 14-seater PSV quickly made use of alternative routes during traffic build up or closure of the road. 35.7% of the respondents agreed that the 14-seater PSV averagely made use of alternative routes during traffic build up or closure of the road. This finding therefore showed that the 14-Seater PSV was quick and had ability to make use of alternative routes during traffic build up or closure of the road.

The majority of the respondents 86.7% observed that 22-32-seater PSV quickly made use of alternative routes during traffic build up or closure of the road. 4.3% of the respondents agreed that the 22-32-seater PSV averagely made use of alternative routes during traffic build up or closure of the road. 9.0% agreed that 22-32-seater PSV was slow in making use of alternative routes. This finding therefore showed that the 22-32-Seater PSV was quick and had ability to make use of alternative routes during traffic build up or closure of the road.

The study established that 15.9% of the respondents observed that 33 and above-seater PSV quickly made use of alternative routes during traffic build up or closure of the road. 23.2% of the respondents agreed that the 14-seater PSV averagely made use of alternative routes during traffic build up or closure of the road. 60.9% of the respondents observed that the 33 and above-seater PSV was slow at making use of alternative routes during traffic build up or closure of the road.

This finding therefore showed that the 33 and above seater PSV was not good in and had ability to make use of alternative routes during traffic build up or closure of the road.

The second hypothesis was stated as the existence of alternative routes has no influence on commuter choice of 14-seater PSV over the other alternative PSV modes. Since the data set in the tool for data collection were qualitative in nature, chi-square was used to establish the relationship between the alternative routes and the commuters' choices of the PSV.

Table 4.6: Relationship between Alternative Routes and the Commuters' choices of PSV

Seater	Degree of freedom	Calculated Chi-Square	Critical Chi-Square
14-Seater	2	22.14	5.99
22-32-Seater	3	529.3	7.82
33 and above seater	3	112	7.82

Source: Field data (2012)

The table above gives an indication that the existence of alternative routes influenced commuters' choice of PSVs since the calculated chi-square for each mode is higher than the critical chi-square.

Table 4.7: Relationship between Alternative Routes and the Commuters' choices of PSV accumulated

Variable	Degree of freedom	Calculated Chi-Square	Critical Chi-Square
Seater	3	221.1	7.82

Source: Field Data (2012)

The calculated chi-square for the 14-seater PSV was 22.14 whereas the critical chi-square was 5.99. The calculated chi-square for the 22-32-seater PSV was 529.3 whereas the critical chi-square was 7.82 and the calculated chi-square for the 33 and above-seater PSV was 112 whereas the critical chi-square was 7.82. Since the calculated chi-square for all the three types of the PSV under the study were far much greater than the critical chi-square, there was evidence to reject the hypothesis that the existence of alternative routes has no influence on commuter choice of 14-seater PSV over the other alternative PSV modes. Accumulated calculated chi-square difference between the types of seater was 221.1 compared to the critical chi-square which was

7.82. All the chi-square results were significant at 0.05. This finding confirmed that the alternative route influenced the commuters' choice of the PSV vehicle they would wish to use.

4.5 The effect of fare charged on the choice of 14-seater PSV over the other alternative PSV modes

The third objective of the study was to establish the extent to which fare charged affects the choice of 14-seater PSV over the other alternative PSV modes.

Table 4.8: Rating of Fare Charged per type of PSV during Peak Time

Rating	14-seater (%)	22-32-seater (%)	33 and above seater (%)
Very High	0	0	9
High	74.5	26.7	43.5
Average	20.3	63.8	44.9
Low	2.6	8.7	2.6
Very Low	2.6	0.9	0
Total	100	100.1	100

Source: Field Data (2012)

The study established that 74.5% of the respondents felt that the fare charged on 14-seater PSV during peak hours were high compared to 20.3% who felt it was average and 5.4% who felt it was low. The majority of the respondents 63.8% felt that the fare charged on 22-32-seater PSV during peak hours were average compared to 26.7% who felt it was high and 9.6% who felt it was low whereas 44.9% felt that the fare charged on 33 and above-seater PSV during peak hours were average compared to 43.5% who felt it was high and 2.6% who felt it was low. This finding showed that the fare charged by the 14-seater PSV during peak hours were high and those charged on 22-32-seater and 33 and above seater were average.

Table 4.9: Rating of Fare Charged per type of PSV during Off-Peak Time

Rating	14-seater	22-32-seater	33 and above seater
Very High	42.6	0.0	0.0
High	31.0	42.6	7.2
Average	19.5	9.4	51.0
Low	4.3	43.5	37.5
Very Low	2.6	4.3	4.3
Total	100.0	99.8	100.0

Source: Field Data (2012)

The table shows 73.6% of the respondents felt that the fare charged on 14-seater PSV during off-peak hours was high compared to 19.5% who felt it was average and 6.9% who felt it was low. 47.8% of the respondents felt that the fare charged on 22-32-seater PSV during off-peak hours were low compared to 42.6% who felt it was high and 9.4% who felt it was average. For the 33 and above seater PSV, 51.0% of the respondents felt that the fare charged were average during off-peak hours compared to 7.2% who felt it was high and 41.8% who felt it was low. This finding showed that the fare charged by the 14-seater PSV during off-peak hours were high, those charged by 22-32-seater were low and 33 and above seater were average.

The third hypothesis of the study was stated as; fare charged has no effect on commuter choice of 14-seater PSV over the other alternative PSV modes. Since the data set in the tool for data collection were qualitative in nature, chi-square was used to establish the relationship between the alternative routes and the commuters' choice of the PSV

Table 4.10: Relationship between Fare Charged and Commuters' choice of the PSV during Peak hours

PSV Mode	Degree of freedom	Calculated Chi-Square	Critical Chi-Square
14-Seater	3	479.46	7.82
22-32-Seater	3	324.83	7.82
33 and above seater	3	206.5	7.82

Source: Field Data (2012)

In the table, the calculated chi-square for the 14-seater PSV was 479.46 whereas the critical chi-square was 7.82. The calculated chi-square for the 22-32-seater PSV was 324.82 whereas the critical chi-square was 7.82 and the calculated chi-square for the 33 and above-seater PSV was 206.5 whereas the critical chi-square was 7.82. Since the calculated chi-square for all the three types of the PSV under the study were far much greater than the critical chi-square, there was evidence to reject the hypothesis that fare charged has no effect on commuter choice of 14-seater PSV over the other alternative PSV modes. The chi-square was significant at 0.05. This finding confirmed that the fare charged during the peak hours influenced the commuters' choice of the PSV vehicle they would wish to use.

Table 4.11: Relationship between Fare charged and Commuters' choice of the PSV during Off-Peak hours

PSV Mode	Degree of freedom	Calculated Chi-Square	Critical Chi-Square
14-Seater	4	203.6	9.49
22-32-Seater	3	181.64	7.82
33 and above seater	3	216.94	7.82

Source: Data Field (2012)

The table indicates that the calculated chi-square for the 14-seater PSV was 203.6 whereas the critical chi-square was 9.49. The calculated chi-square for the 22-32-seater PSV was 181.64 whereas the critical chi-square was 7.82 and. the calculated chi-square for the 33 and above-seater PSV was 216.94 whereas the critical chi-square was 7.82. Since the calculated chi-square for all the three types of the PSV under the study were far much greater than the critical chi-square, there was evidence to reject the hypothesis that fare charged has no effect on commuter choice of 14-seater PSV over the other alternative PSV modes. This finding confirmed that the fare charged during the off-peak hours influenced the commuters' choice of the PSV vehicle they would wish to use.

4.6 Time taken to walk from drop-off point to workplace and the choice of 14-seater PSVs over the other alternative PSV modes

The fourth objective of the study was to investigate the influence of time taken to walk by a commuter from drop-off point to workplace on his/her choice of 14-seater PSV over the other alternative PSV modes.

Table 4.12: Descriptive Statistics of Time taken to walk from House to Pick-up Point

PSV	Min. (Min)	Max (Min)	Mean (Min)	Std.dev. (Min)
14-seater	1	15	2.67	2.16
22-32-seater	2	4	2.33	0.62
33 and above seater	1	4	2.67	0.63

Source: Field Data (2012)

The study established that the shortest time taken by the respondents to walk from the house to the pick-up point was 1 minute whereas the longest was 15 minutes. On the other hand, the respondents took the shortest time 2.33 minutes to walk from their houses to the stage where they picked a 22-32-seater PSV whereas for 14-seater and 33 and above seater, they each took

2.67 minutes. This finding showed that the 22-32-seater PSV were most accessible to the commuters compared to 14 and 33 and above seaters in terms of time it took them to walk from their houses to the pick-up points.

The fourth hypothesis of the study was stated as the time taken to walk by a commuter has no influence on choice of 14-seater PSV over the other alternative PSV modes. Because the nature of data on the time variable was quantitative, the study used linear regression analysis to test this hypothesis.

Table 4.13: Analysis of Variance in the Walking Time and choice of PSV

Model	Sum of square	Degree of freedom	Mean Square	F-Value
Regression	5469.1	2	2734.5	976.4
Residual	957.8	342	2.8	
Total	6426.9	344		

Source: Field Data (2012)

The calculated F value at 2 degree of freedom was 976.4 was much greater than the critical F value which was 99.0 showing significant difference in time taken between the different seaters which is further expressed in the regression model below.

Table 4.14: Spearman Correlation between 14-Seater PSV and Preferred Alternative Mode

Constant	Std. Coefficient	t-value
22-32-Seater	0.057	36.59
33 and above-seater	0.036	9.97

Source: Field Data (2012)

The dependent variable was 14-seater PSV whereas the independent variable was 22-32-seater PSV and 33 and above seater PSV. The study established a correlation of 5.7% between 14-seater PSV and 22-32-seater PSV compared to 3.6% correlation between 14-seater PSV and 33 and above-seater PSV. The hypothesis that the time taken to walk by a commuter has no influence on choice of 14-seater PSV over the other alternative PSV modes was accepted since there was a weak correlation between 14-seater PSV and 22-32-seater PSV. This correlation showed that the respondents took the same time regardless of the PSV choice from their houses to the PSV pick-up points (See table 4.19 above). Hence time taken from drop-off point to work-place is not correlated to preference of 14-seater to other alternatives.

4.7 Time taken to board to full capacity a PSV and the choice of 14-seater PSVs over the other alternative PSV modes

The fifth objective of the study was to investigate the influence of time taken to board to full capacity a PSV on a commuter's choice of 14-seater PSV over the other alternative PSV modes.

Table 4.15: Descriptive Statistics of the Time taken to board a PSV to full capacity

PSV Mode	Min. (Min)	Max (Min)	Mean (Min)	Std.dev. (Min)
14-seater	2	10	5.2	2.17
22-32-seater	1	20	10.0	4.44
33 and above-seater	2	20	10.6	5.89

Source: Filled Data (2012)

It is evident from the table that the shortest time taken by the respondents to board a PSV to full capacity was 1 minute whereas the longest was 20 minutes. The respondents took the shortest mean time of 5.2 minutes to board to capacity a 14-seater PSV whereas for 22-32-seater and 33 and above seater, they took 10.0 and 10.6 minutes respectively. This finding showed that the 14-seater PSV took the shortest time to board a PSV to full capacity compared to 22-32-seaters and 33 and above seaters.

4.8 Analysis of Regression Results for the 14-seater

The hypothesis of the study was stated as time taken to board a PSV to full capacity has no influence on the choice of 14-seater PSV over the other alternative PSV modes. Because the nature of data on the time variable was quantitative, the study used linear regression analysis to test this hypothesis. The study at its design used the regression below with its detail variable explanation.

The regression models are $M_i = f(F,Tv,T_{w1},T_{w2},Cn,Alt,T_F)$, i=1,2,3,4,5,6

Where

M = Frequency of use of mode per month

i = 1-passenger two-wheeler, 2-3 passenger three-wheeler, 4-7-seater taxi, 14-seater, 22-32-seater, 33 seats and above. Comment why on them

F = Fare charged, D = Distance travelled for fare charged, F_A = Fare charged by alternative mode

T_v = Time taken travelling in the PSV boarded, T_{w1}= Time taken to walk from house to PSV boarding place, T_{w2}= Time taken to walk from the last stage to workplace, Cn = the number of vehicles boarded from house to workplace, Alt = the number of alternative routes used by the PSV in the past, T_F = Time taken to board a PSV to full capacity at the boarding place, $S_i = \frac{DIST_i}{T_i}$

$DIST_i$ = Distance from home to workplace in kilometers, T_i = Total time taken from home to workplace by given mode ($T_v + T_{w1} + T_{w2} + T_F$) and M_i and D_i represent preference of mode.

Table 4.16: Analysis of Variance of choice of 14-Seater

Model	Sum of square	Degree of freedom	Mean Square	F-Value
Regression	1622.9	7	231.9	11.33
Residual	6896.4	337	20.5	
Total	8519.3	344		

Source: Field data (2012)

Table 4.18 is the ANOVA results of the regression of 14-seater choice against the chosen explanatory variables that is given in table 4.19.

Table 4.17: Regression Results for choice of 14-seater

Model	Standardized Coefficient	t	Sig(p-value)
F	-0.412**	-8.29	0.031
Tv	0.077	0.945	0.341
Tw1	0.095	1.866	0.633
Tw2	-0.01	-0.205	0.842
Cn	-0.036	-0.400	0.691
Alt	-0.079	-1.176	0.242
TF	-0.011	-0.192	0.841

Source: Field data (2012) – Dependent variable is frequency of use of 14-seater

** Significant at 5% level

In the model, choice mode was the dependent variable whereas the independent variables as per the model were; Fare charged, Fare charged by alternative mode, Time taken travelling in the PSV boarded, Time taken to walk from house to PSV boarding place, Time taken to walk from the last stage to workplace, the number of vehicles boarded from house to workplace, the number of alternative routes used by the PSV in the past and Time taken to board a PSV to full capacity at the boarding place.

The study obtained a coefficient of -0.412 of fare charged by the mode of transport used was statistically significant at 5%. Hence fare charged by the 14-seater explained the choice of the 14-seater. This finding implied that there is an inverse relationship between fare charged and choice of the 14-seater in that an increase in fare charged will result in less likelihood of the mode being chosen and vice versa. The other factors were not statistically significant in explaining the choice of the mode.

4.8.1 Findings on time taken to travel from house to workplace

The first objective of the study was to determine if time taken to travel from house to workplace influences the choice of 14-seater PSVs over the other alternative PSV modes.

The hypothesis that travel time from house to workplace has no influence on choice of 14-seater PSV over the other alternative PSV modes was accepted since there was a strong correlation between times taken from house to pick-up point of 14-seater PSV. The same finding obtained for the 22-32-seater and 33 and above seater PSVs. This showed that the preference for a 14-seater is not related to the time they take from their houses to the PSV pick-up points. Instead, it is fare charged which determined its choice over the other modes.

4.8.2 Findings on the influence of alternative routes on choice of mode of transport

The second objective of the study was to establish the extent to which the number of alternative routes influences the choice of 14-seater PSV over the other alternative PSV modes.

Its hypothesis stated that the existence of alternative routes has no influence on commuter choice of 14-seater PSV over the other alternative PSV modes.

It was realized that there was evidence to reject the hypothesis that the existence of alternative routes has no influence on commuter choice of 14-seater PSV over the other alternative PSV modes. This finding confirmed that all the modes made use of alternative routes and that the ability to use the said alternative routes influenced the commuters' choice of the PSV vehicle they would wish to use. This finding favored the 14-seater and 22-32-seaters and not the 33 and above seaters.

4.8.3 Findings on the effect of fare charged on choice of mode of transport

The third objective of the study was to establish the extent to which fare charged affects the choice of 14-seater PSV over the other alternative PSV modes whereas the hypothesis stated that fare charged has no effect on commuter choice of 14-seater PSV over the other alternative PSV modes.

The hypothesis was tested using Chi-square and was found to be significant at 0.05. This finding confirmed that the fare charged influenced the commuters' choice of the 14-seater PSVs as it did for the other alternative modes.

4.8.4 Findings on time taken to walk

The fourth objective was to investigate the influence of time taken to walk by a commuter on his/her choice of 14-seater PSV over the other alternative PSV modes and the hypothesis stated that the time taken to walk by a commuter has no influence on choice of 14-seater PSV over the other alternative PSV modes.

The hypothesis was accepted since there was a weak correlation between 14-seater PSV and 22-32-seater PSV. Similarly the correlation between 14-seater PSV and 33 and above seater on the same aspect was weak. This correlation showed that the respondents took the same time regardless of the PSV choice. Hence time taken to walk is not correlated to preference of 14-seater to other alternatives.

Time taken to walk from house to the pick-up point was of significance for a commuter who wanted to board a 22-32-seater PSV. A commuter preferred 33 and above seater based on the time taken to walk from drop-off point to the workplace.

4.8.5 Findings on time taken to board a PSV to full capacity on commuter's choice of mode of transport

The fifth objective was to investigate the influence of time taken to board a PSV to full capacity on a commuter's choice of 14-seater PSV over the other alternative PSV modes and the hypothesis stated that time taken to board a PSV to full capacity has no influence on the choice of 14-seater PSV over the other alternative PSV modes.

Finding on the hypothesis showed that the 14-seater PSV took the shortest time to board a PSV to full capacity compared to 22-32-seaters and 33 and above seaters. However, the regression analysis depicted travel time as being of no consideration when a commuter is looking for a 14-seater PSV to board. Time taken to board a PSV to full capacity at the boarding place was considered significant when a commuter intended to board a 22-32-seater PSV or a 33 and above seater PSV.

4.9 Regression analysis results of 22-32-seater and 33 and above seater PSVs

Table 4.18: Regression analysis of 22-32-seater against F, Tv, Tw1, Tw2, Cn, Alt and TF

Model	Coefficient	t-value	Sig(p-value)
F	-0.293**	-3.924	0.018
Tv	-0.244	-11.723	0.172
Tw1	0.857	3.16	0.213
Tw2	0.076***	1.493	0.006
Cn	0.568	4.705	0.136
Alt	0.106*	2.396	0.072
TF	-0.187**	-3.146	0.023

Source: Field Data (2012)

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

In the model, choice mode was the dependent variable whereas the independent variables as per the model were; Fare charged, Fare charged by alternative mode, Time taken travelling in the PSV boarded, Time taken to walk from house to PSV boarding place, Time taken to walk from

the last stage to workplace, the number of vehicles boarded from house to workplace, the number of alternative routes used by the PSV in the past and Time taken to board a PSV to full capacity at the boarding place. The study established the fare charged by the mode of transport used negatively influenced the choice such that an increase in fare charged lead to a less likelihood of the mode being chosen by the commuter. Also the time taken to walk from the last stage to workplace was found to be significant in explaining the choice of the mode in that the more the time taken from the last drop-off point to the workplace the greater the likelihood of the mode being chosen. The 22-32-seater PSV caters for unique commuters who come from far destinations that are not conveniently served by other modes hence they walk for longer distances to reach their workplaces. The time taken to board to full capacity this mode of PSV at the boarding place did influence the choice in that the faster it took (less time) to board a PSV to full capacity the more likely the mode was chosen and vice versa. This statement having been confirmed statistically makes the study to accept the hypothesis that time taken to board a PSV to full capacity has no influence on the choice of 22-32-seater PSV over the other alternative PSV modes.

Table 4.19: Regression analysis of 33 and above seater against other factors

Model	Standardized Coefficient	t	Sig (p-value)
F	-0.722***	-19.559	0.000
Tv	0.929*	17.716	0.081
Tw1	-0.528**	-3.395	0.015
Tw2	0.036	1.457	0.146
Cn	-0.523**	-9.320	0.015
Alt	0.084*	3.856	0.053
TF	0.801**	27.215	0.042

Source: Field Data (2012)

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

The study established a coefficient of -0.722 of fare charged by the mode of transport used, 0.528 of time taken to walk from the house to the pick-up point, 0.523 of the number of vehicles

boarded from house to workplace, and 0.801 of time taken to board a PSV to full capacity at the boarding place were significant at 5%. This finding showed that the fare charged by this mode of transport is inversely related to the choice of 33-seater PSV over the other alternative PSV modes. This means that an increase in fare charged results in the likelihood of the mode being chosen and vice versa. Time taken to walk from house to pick-up point is negatively related to choice of the mode, implying that the more the time taken to walk from house to the pick-up point the less likely the choice. The number of vehicles boarded resulting from the choice of this mode of transport negatively influences the choice of the 33 and above-seater thus the more the number of vehicles used by a commuter to get to the workplace the less the likelihood that the mode will be chosen. The time taken to board to full capacity the PSV mode at the boarding place influenced the choice of the mode. The positive relationship between the time taken to fully board to capacity the 33 and above-seater and the choice of the mode is as a result of the uniqueness of the commuters served by this mode. The commuters served by this mode ply routes that are not conveniently served by other modes hence the positive relationship.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Findings

Over the years, Public Service Vehicle (PSV) has gone through several policy transformations. In spite of these policy changes, the implementation has ever remained a challenge to all the implementing agencies. Coupled with numerous road accidents that have occurred in the past, there has ever been a need to reform the sector further particularly by replacing the 14-seater with those of a higher capacity such as 22-32-seater and 33 and above-seaters. The main aim of this study was to analyze the efficiency of 14-seater public service vehicles and alternative modes of public service transport in Nairobi city.

The study has come up with a number of very important findings that give indications of the factors influencing choice of 14-seater public service vehicles and alternative modes of public service transport. Each finding is hereby summarized under the corresponding objective.

The study established that the shortest distance covered by the respondents was 100 metres whereas the longest was 1000 metres. The shortest time taken by the respondents to reach stage where they took a PSV was 5 minutes whereas the longest was 15 minutes. Also, the study established a higher correlation in terms of time taken to reach the pick-up point between 14-seater PSV and 22-32-seater PSV compared to lower correlation between 14-seater PSV and 33 and above-seater PSV.

From the research findings, it was established that a majority of the respondents observed that 14-seater PSV quickly made use of alternative routes during traffic build up or closure of the road. The existence of alternative routes had influence on commuter choice of 14-seater PSV over the other alternative PSV modes.

The study found out that the majority of the respondents felt that the fare charged on 14-seater PSV during peak hours were high compared to 22-32-seater and 33 and above-seaters. Furthermore, it was established that fare charged had effect on commuter choice of 14-seater PSV over the other alternative PSV modes. The implication of this is that when fare charged by 14-seater increases there will be a reduction in the choice of the mode of transport. This means

that in order to reduce the purchase of 14-seater and hence their use as PSV, the fare can be increased through use of specific tax on 14-seater or offer subsidies (or tax waivers) for 33-seater PSVs.

On the time taken to walk from drop-off point to workplace and the choice of 14-seater PSVs over the other alternative PSV modes, it was realized that the shortest time taken by the respondents to walk from drop-off point to the workplace was 1 minute whereas the longest was 15 minutes. There was a low correlation between 14-seater PSV, 22-32-Seater PSV and 33 and above-seater PSV. This low correlation showed that the time taken to walk by a commuter has no influence on choice of 14-seater PSV over the other alternative PSV modes.

The least time taken by the respondents to board a PSV to full capacity was 1 minute whereas the longest was 20 minutes and that there was a low correlation between 14-seater PSV and 22-32-seater PSV and 33 and above-seater PSV. This low correlation indicated that time taken to board a PSV to full capacity had no influence on choice of 14-seater PSV over the other alternative PSV modes.

5.2 Conclusion

PSV is very important in the economic development in Kenya as a means of transporting citizens to different work places where they are involved actively in economic development and wealth creation. The conclusion on the factors influencing choice of 14-seater public service vehicles and alternative modes of public service transport in Nairobi city is as summarized; travel time from house to workplace had influence on choice of 14-seater PSV over the other alternative PSV modes. There was a higher correlation between 14-seater and 22-32 seater meaning that the commuters would rather choose 22-32 seater over 33 seaters and above; the existence of alternative routes had influence on commuter choice of 14-seater PSV over the other alternative PSV modes; fare charged had effect on commuter choice of 14-seater PSV over the other alternative PSV modes; the fare charges during the off-peak hours influenced the commuters' choice of the PSV vehicle they would wish to use; and lastly, the time taken to walk by a commuter had no influence on choice of 14-seater PSV over the other alternative PSV modes.

The regression results established that fare charged influenced commuters' choice of 14-seater PSVs. The choice of 22-32-seater PSVs was mainly influenced by fare charged, time taken to

walk from drop-off point to the workplace, the existence of alternative routes and the time it takes for it to be fully boarded at the initial boarding place. The 33 and above seater was considered based on fare charged, travel time in the PSV, time taken to walk from the house to the PSV pick-up point, usage of more than one vehicle to get to the workplace, the existence of alternative routes and lastly, time taken for it to be fully boarded to capacity at the initial boarding place. The commuter transport system could be re-designed in a way that time taken to board a PSV to full capacity will favor the vehicles with higher capacity. The system should also reduce the number of connections a commuter makes while travelling from house to work place and vice versa.

The findings concur with the work of Hensher (1976) whose theory revealed that the acceptance of one means of transport and the rejection of the others is an indication of preference. Travel time, dictated by the characteristics of the mode of transport determined the choice of mode of transport.

5.3 Recommendations

From the findings and conclusion of this study, it is recommended that a comparative policy analysis should be undertaken to come up with a hybrid PSV policy that can serve the Kenyan commuter. The process of coming up with alternative type of PSV should be based on more consultation and sector wide considerations. It is clear from the analysis that in the absence of the 14-seater PSVs on the roads most commuters would opt for 22-32-seater PSVs. Holistic factors should therefore be considered by the government and all stakeholders when coming up with alternative type of PSV because there could be other underlying factors that were not captured in this study and yet they are important in determining a commuter's choice of a PSV to use.

The government should not phase out 14-seater PSVs by force but increase taxes and levies on anybody who may want to buy a 14-seater which would by extension make fare high and hence make commuters shy away from the 14-seater. Indeed, such a move would result in commuters considering other modes of transport suitable to them without feeling coerced.

Instead of banning the use of 14-seater PSVs, the government would still be able to achieve the same by introducing operational regulations on the use of 14-seater PSVs that would make it

unattractive to both investors and commuters. This way, the government will discourage investors from investing in 14-seater PSVs hence they naturally fizzle out from the roads.

The following related areas can be researched on to add up to the knowledge gap that this study has tried to abridge: - studies on the impact of Legal Notice 161and other government policies on the PSV commuters' safety and satisfaction should be conducted. The findings from this study will enable the government, private sector players and other stakeholders to know whether the envisaged PSV changes were useful to the commuters. One other area that can be explored is the effect of the newly constructed Eastern and Southern road by-passes in Nairobi on traffic flow and or traffic congestion in Nairobi.

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APPENDICES

Appendix I: LETTER OF AUTHORITY

P. O. Box 13375,
Nakuru,
October, 2011.

The Human Resource Officer,

Ministry of .....

Nairobi.

Dear Sir/Madam,

RE: AUTHORITY TO COLLECT DATA FOR RESEARCH

I am a postgraduate student pursuing a Master of Business Administration degree at Egerton University. I am carrying out a research on "**An analysis of factors influencing choice of 14-seater public service vehicles and alternative modes of public service transport in Nairobi city**".

I write this letter to seek your authority to allow me to collect research data from employees in your organization/institution. It is my belief that the organization/institution will benefit from this study because it will provide information on the best mode of transport that will enable employees using public transport to arrive at work in time and remain productive due to the efficiency of service in the transport sector.

The study may result in recommendations/suggestions which may assist in identifying the most suitable means of public transport for employees and those who seek services at your offices.

The data collected was used for research purposes only.

Yours Faithfully,

Isaac C. Koimur

CM11/0514/09

Appendix II: SPECIMEN LETTER TO THE RESPONDENTS

Egerton University,

Nakuru Town Campus,

P. O. Box 13357 – 20100,

NAKURU.

Dear Sir/Madam,

I am a postgraduate student pursuing a Master of Business Administration degree at Egerton University.

I am carrying out a research on the title "**An analysis of factors influencing choice of 14-seater public service vehicles and alternative modes of public service transport in Nairobi city**".

I request you to be one of the respondents for this research since you commute daily to and from work in the city of Nairobi.

My Supervisors and I assure you that the information you give was used specifically for research purposes and thus your views was treated confidentially.
Any report from this study will show only statistical summaries and not individual responses.
Thank you for your cooperation and for assisting me in this project work.

Koimur C. Isaac
MBA Student-Egerton University

Appendix III: GOVERNMENT MINISTRIES IN KENYA

1. Office of the president
2. Office of the Vice President and Ministry of Home Affairs
3. Office of the Prime Minister
4. Ministry of Agriculture
5. Ministry of Cooperative Development and Marketing
6. Ministry of Defense
7. Ministry of Development of Northern Kenya and other Arid Lands
8. Ministry of East African Community
9. Ministry of Education
10. Ministry of Energy
11. Ministry of Environment and Mineral Resources
12. Ministry of Finance
13. Ministry of Fisheries Development
14. Ministry of Foreign Affairs
15. Ministry of Forestry and Wildlife
16. Ministry of Gender, Children and Social Development
17. Ministry of Higher Education, Science and Technology
18. Ministry of Home Affairs
19. Ministry of Housing
20. Ministry of Immigration and Registration of Persons
21. Ministry of Industrialization
22. Ministry of Information and Communications
23. Ministry of Justice, National Cohesion and Constitutional Affairs
24. Ministry of Labour
25. Ministry of Lands
26. Ministry of Livestock Development
27. Ministry of Local Government
28. Ministry of Medical Services
29. Ministry of Nairobi Metropolitan Development
30. Ministry of Public Health and Sanitation

31. Ministry of Public Works
32. Ministry of Regional Development Authorities
33. Ministry of Roads
34. Ministry of State for National Heritage and Culture
35. Ministry of State for Planning, National Development, and Vision 2030
36. Ministry of State for Provincial Administration and National Security
37. Ministry of State for Public Service
38. Ministry of State for Special Programmes
39. Ministry of Tourism
40. Ministry of Trade
41. Ministry of Transport
42. Ministry of Water and Irrigation
43. Ministry of Youth and Sports
44. State Law Office

Source: www.communications.go.ke

Appendix IV: CLASSIFICATION OF MODES OF TRANSPORT

This study focused on road public passenger transport. The modes of transport were categorized according to the carrying capacity of the vehicle, motor cycle or tri-cycle. The modes were PSV 1-passenger two-wheeler, PSV 2-3 wheeler Three- passenger, PSV 4-7-seater taxi, PSV 14-seater, PSV 22-32-seater and PSVs with 33 seats and above.

The study narrows down to the above modes of public passenger transport because they all operate under similar conditions. Furthermore, the study sought to investigate the factors that shape the riders' perception on mode of transport hence choice of mode.

It is worth noting that the 14-seater PSV was targeted for phasing out and it was one of the modes investigated. Since all the modes operate in the same environment, it was possible to compare the findings on the14-seater PSVs and those of the other modes of public transport.

Other modes of public passenger transport are air, rail and sea. These modes were not factored in the study because they did not operate in the same conditions as the 14-seater PSVs. The study focused on motorized road transport and thus, bicycles were excluded.

When the study was conducted, very little data on 1-passenger two wheeler, PSV 2-3 wheeler Three - passenger and PSV 4-7-seater taxi was captured. It was in that connection that data for the stated modes was not factored in during data analysis.

Appendix V: CALENDAR OF WORK AND TIME SCHEDULE

Work/Activity	Time Schedule
Writing of proposal	March, 2011-October, 2011
Proposal defense	December, 2011-February, 2012
Data collection	April, 2012 - July, 2012
Data analysis	August, 2012 – September, 2012
Report writing	October, 2012 - November, 2012
Presentation	December, 2012

Appendix VI: DATA COLLECTION INSTRUMENT

Research Questionnaire

I am a student pursuing a Master of Business Administration course at Egerton University.

The questionnaire you are about to fill seeks information on public passenger transport. As one of the commuters using motorized public passenger transport the responses you provide is of great value to the research study. The answers you give was used only in the research study and treated confidential.

Do not write your name.

1. Kindly tick (√) against your gender: Male ☐ Female ☐
2. In the list below, kindly tick (√) against the age bracket you belong to.

18-25 ☐

26-30 ☐

31-35 ☐

36-40 ☐

41-45 ☐

46-50 ☐

Over 50 ☐

3. How long have you been a resident of Nairobi?.....
4. Which Ministry do you work in?.....,Depart ment?.....
5. Which route(s) do you use to commute to your workplace?.....
   .....
6. Approximately how long have you been commuting between your house and your current workplace?.....
7. How much time do you take to travel from your house to your workplace.....

8. What distance do you cover walking from your house to the nearest point where you board a public passenger service vehicle as you go to the office?

PSV Mode	Distance covered
1-passenger two-wheeler	
2-3 wheeler Three- passenger	
4-7-seater taxi	
14-seater	
22-32-seater	
33 seats and above	

9. How many minutes do you take walking from your house to the point of boarding a public passenger vehicle as you go to the office?

PSV Mode	Time taken
1-passenger two-wheeler	
2-3 wheeler Three- passenger	
4-7-seater taxi	
14-seater	
22-32-seater	
33 seats and above	

10. How long do you have to wait for a public passenger vehicle to arrive at the point of boarding?

PSV Mode	Waiting time
1-passenger two-wheeler	
2-3 wheeler Three- passenger	
4-7-seater taxi	
14-seater	
22-32-seater	
33 seats and above	

11. How many times do you use the modes listed below in a month?

PSV Mode	Frequency per month	Fare charged	Distance travelled for fare charged	Fare charged by alternative mode	Time taken travelling in boarded PSV	Time taken to walk from house to PSV boarding point	Time taken to walk from the last stage to workplace	Number of vehicle boarded from house to workplace	Number of alternative routes used by the PSV in the past	Time taken to board a PSV to full capacity at the boarding place
1-passenger two-wheeler										
2-3 wheeler Three-passenger										
4-7-seater taxi										
14-seater										
22-32-seater										
33 seats and above										

12. How do you rate the convenience of the modes of transport listed below?

PSV Mode	Most convenient (5)	Convenient (4)	Indifferent (3)	Inconvenient (2)	Most inconvenient (1)
1-passenger two-wheeler					
2-3 wheeler Three-passenger					
4-7-seater taxi					
14-seater					
22-32-seater					
33 seats and above					

13. How much time does each of the following public passenger vehicle modes take for passengers to fully board a PSV to full capacity at the initial pick-up point?

PSV Mode	Time	Fastest (5)	Fast (4)	Average (3)	Slow (2)	Very slow (1)
1-passenger two-wheeler						
2-3 wheeler Three-passenger						
4-7-seater taxi						
14-seater						
22-32-seater						
33 seats and above						

14. Tick against the option which best describes the rate at which the following public passenger vehicle modes take for passengers to board to full capacity at the initial pick-up point?

PSV Mode	Fastest (5)	Fast (4)	Average (3)	Slow (2)	Very slow (1)
1-passenger two-wheeler					
2-3 wheeler Three-passenger					
4-7-seater taxi					
14-seater					
22-32-seater					
33 seats and above					

15. How much time elapses between the departure of one vehicle and arrival of another of the same capacity when one is at the bus stop?

PSV Mode	Time interval in arrival of two consecutive vehicles									
	Morning travel					Evening travel				
	Very Fast (5)	Fast (4)	Average (3)	Slow (2)	Very slow (1)	Very Fast (5)	Fast (4)	Average (3)	Slow (2)	Very slow (1)
1-passenger two-wheeler										
2-3 wheeler Three-passenger										
4-7-seater taxi										
14-seater										
22-32-seater										
33 seats and above										

16. What distance do you cover and what time do you take from the pick-up point to:

Destinations	Distance covered	Time taken	Fare charged	
			Peak(Rush-hour) time	Off-Peak
First destination				
Between first and second destination				
Between second and third destination				
Between third and fourth destination				
Your workplace				

17. How much time do you spend walking from the time you alight from a PSV at the bus stop near your office to the time you arrive at the office given that you board the options given below?

PSV Mode	Time	Fastest (5)	Fast (4)	Average (3)	Slow (2)	Very slow (1)
1-passenger two-wheeler						
2-3 wheeler Three-passenger						
4-7-seater taxi						
14-seater						
22-32-seater						
33 seats and above						

18. If your answer to question 14 above is yes, how much is charged in vehicles having the following capacity

PSV Mode	Fare charged									
	Peak(Rush-hour) time					Off-Peak				
	Very high (5)	High (4)	Average (3)	Low (2)	Very low (1)	Very High (5)	High (4)	Average (3)	Low (2)	Very low (1)
1-passenger two-wheeler										
2-3 wheeler Three- passenger										
4-7-seater taxi										
14-seater										
22-32-seater										
33 seats and above										

19. Approximately how often have you boarded the modes of passenger vehicles listed below?

PSV Mode	Very Frequent (5)	Frequent (4)	Occasionally (3)	Rarely (2)	Never (1)
1-passenger two-wheeler					
2-3 wheeler Three- passenger					
4-7-seater taxi					
14-seater					
22-32-seater					
33 seats and above					

20. In your opinion, which mode of transport takes the shortest time to maneuver through a road intersection and a bus stop?

PSV Mode	Motion through an intersection					Motion through a bus stop				
	Very Fast (5)	Fast (4)	Average (3)	Slow (2)	Very slow (1)	Very Fast (5)	Fast (4)	Average (3)	Slow (2)	Very slow (1)
1-passenger two-wheeler										
2-3 wheeler Three-passenger										
4-7-seater taxi										
14-seater										
22-32-seater										
33 seats and above										

21. Should the road be closed or a traffic jam builds up and alternative routes exist, vehicles of which capacity are quick at making use of the alternative routes

PSV Mode	Very Quick (5)	Quick (4)	Average (3)	Slow (2)	Never (1)
1-passenger two-wheeler					
2-3 wheeler Three-passenger					
4-7-seater taxi					
14-seater					
22-32-seater					
33 seats and above					

22. There is a plan of phasing out the 14-seater PSVs. In the event that the said vehicles are out of the roads, which mode of transport from the choices below would you opt for?(*label in order of priority from 1 to 6*)

PSV Mode	Rank
PSV 1-passenger two-wheeler	
PSV 2-3 wheeler Three- passenger	
PSV 4-7-seater taxi	
PSV 14-seater	
PSV 22-32-seater	
PSV 33 seats and above	

Thank you for being kind enough and for using your precious time to fill in this questionnaire and for accepting to be one of the respondents in this research study.